

**INTERRUPTIVE COMMUNICATION PATTERNS
IN THE INTENSIVE CARE UNIT WARD ROUND**

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ABSTRACT

Medical error and patient safety have become important issues. It is clear that medical error is more influenced by systemic factors rather than human characteristics. Communication patterns, in particular interruptive communication, maybe one of the systemic factors that contribute to the burden of medical error.

Objective: An exploratory study to examine interruptive communication patterns of healthcare staff within an intensive care unit during ward rounds.

Methods: The study was conducted in a tertiary hospital in Sydney, Australia. Nine participants were observed individually, for a total of 24 hours, using the Communication Observation Method (COM). The amount of time spent in conversation, the number of conversation initiating and number of turn-taking interruptions were recorded.

Results: Participants averaged 75% [95% confidence interval 72.8-77.2] of their time in communication events during ward rounds. There were 345 conversation-initiating interruptions (C.I.I.) and 492 turn-taking interruptions (T.T.I.). C.I.I. accounted for 37% [95%CI 33.9-40.1] of total communication event time (5hr: 53min). T.T.I. accounted for 5.3% of total communication event time (56min).

Conclusion: This is the first study to specifically examine turn-taking interruptions in a clinical setting. Staff in this intensive care unit spent the majority of their time in communication. Turn taking interruptions within conversations occurred at about the same frequency as conversation initiating interruptions, which have been the subject of earlier studies. These results suggest that the overall burden of interruptions in some settings may be significantly higher than previously suspected.

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CHAPTER 1 - INTRODUCTION

Alexander Pope penned the famous quotation “To err is human, to forgive divine” while writing *An Essay on Criticism*. Pope was trying to convey that the human condition is naturally imperfect, and, that those who accept this notion have a higher understanding of themselves and the world they live in. Mr. Pope’s insightful introspection is still largely lost on many in the medical community.

Young physicians from the beginning of medical school and throughout their training are socialised to strive for an error free practice of medicine (1). Little attention is given to the importance of collaboration. Thus, physicians may graduate with the perilous idea that they are the sole source of important patient decisions, and with little experience in functioning as part of a broader healthcare team. Within many medical schools lies a hidden curriculum that doctors possess absolute knowledge. This model for educating medical students assumes that students must master a finite body of knowledge to become physicians (2). Students are taught that diligence and expertise will prevent error and therefore improve patient outcomes. When students are asked to critique their medical education, the responses can be disappointing (3;4). However, medical schools are beginning to respond to the student’s feedback and attempt to improve their curriculum (5-7).

Risk management in medicine traditionally involves *damage control*. After an incident occurs, efforts are focused on reducing financial loss, ascribing blame, often to an individual; and taking action to discipline the offending person (8). It is easier to attribute error to incompetence than to accept that error may be random and often a result of the environment or system. Generally, the

“human” referred to when an incident is credited to human error is an individual or team working at the “sharp end” of the system (9). Practitioners at the sharp end interact with the potentially risky process of the system, for example, the outdated anaesthetic machine or combating fatigue because of lack of sleep. Those at the “blunt end” of the system manage safety via constraints influencing the practitioner at the sharp end. In medicine, the blunt end includes government, hospital administrators and insurance companies.

Blaming the fallible individuals at the sharp end is universal, natural, emotionally satisfying, and often, legally convenient. Unfortunately, it has little remedial value (1;10). On the contrary, blame focuses our attention on the last and least remediable link in the accident chain: the person at the sharp end! One of the rudimentary principles of error management is that fleeting mental states associated with error production—inattention, distraction, forgetting, etc—are the last and least manageable links in the error chain because they are both unintended and, for the most part, unpredictable (9).

One of the better reviews on human error comes from James Reason (11). A central thesis of his book is that the ways in which errors manifest themselves is inextricably bound to how stored knowledge is selected and retrieved in response to current situational demands. Reason illustrates his point by quoting Ernst Mach, “Knowledge and error flow from the same mental sources, only success can tell the one from the other.” Reason uses this analogy to describe that correct performance and errors are two sides of the same coin, or more appropriately, different sums to the same cognitive balance sheet. The resource limitations of this cognitive ‘workspace’, that are essential for focusing a person upon particular aspects of the world, also contribute to informational overload and memory loss (12). Therefore, Reason argues that error analysis should

not seek to assign blame or responsibility but rather seek to establish causal factors and patterns in exhibited behavior.

The psychological definition of “error” can only be applied to an intentional action. It has no significance in relation to non-deliberate behavior because an error depends upon two kinds of failure (11):

- (1) Planning—the failure of intended actions to achieve desired consequence, and,
- (2) Execution—the failure of actions to go as intended.

This is akin to proving criminal liability where one must show both *actus rea* and *mens rea*. Errors can be classified as active if the error’s effect is felt almost immediately. Conversely, a latent error (and its consequences) can lay dormant within a system. It is not until the latent error combines with other factors that it will overwhelm the systems’ normal ability to detect and prevent the error. In general, active errors are associated with the operators of a system—the pilot, mechanic or doctor. On the other hand, latent errors are spawned from factors that are removed from the sharp end—the designer of the anesthetic machine or the nurse manager who understaffed the emergency department. Latent error is analogous to the *resident pathogen* metaphor described by Reason (11). This concept emphasizes the significance of contributory factors present in the system before an accident sequence begins. All systems contain potentially destructive agents, like pathogens within a human body. These pathogens are usually kept at bay, detected or eliminated with our defense system. Unfortunately, the occasional external circumstance conspires with the resident pathogen to overpower our immunity. It’s these latent factors that often pose the greatest risk and are responsible for much of the “human error” in the workplace. Many authors agree that to be successful in preventing medical error and improve patient safety, we need to look at the system and move away from the individual (13-16).

The main goal of this thesis is to discuss how interpersonal communication, during an intensive care unit ward round, may be a potential source of latent error. The intensive care unit (ICU) is the location in any hospital where the sickest medical and surgical patients reside. These patients have a variety of medical and surgical conditions but they all share one detail in common, the serious nature of their disease processes. Therefore, ICU patients range from those who are convalescing post-operatively to those patients who have invasive technological monitoring and are on life support.

In Australia, a dedicated team of doctors, nurses and support staff are responsible for the management decisions of ICU patients. During any day, one or two “ward rounds” will be performed. This is the time during the day where all patients are examined, reviewed and day’s plan discussed among the ICU team. This decision can range from the discharge of the patient to withdrawal of care.

The structure of this thesis will be as follows:

Chapter 2: A review of the medical error literature. First, a brief historical timeline looking at how the medical community began to appreciate medical error. This will be followed by more recent attempts to quantify and understand the processes that undermine medical error. The aviation industry will be used as a template on how medicine *needs* to adopt important changes in order to understand and prevent error. The general consensus is to stop blaming individuals and start looking towards system solutions if there is any hope of controlling medical error.

Chapter 3: A specific look at communication and interruption as a system or “latent” source of medical error. A review of communication issues that occur within healthcare will be followed by an emphasis on the ICU. In particular, is there a pattern of communication among health professionals that predisposes them to making unwanted errors? Conversational interruptions will be specifically highlighted as a latent source of error. Hypotheses from cognitive psychology will be used as an argument to the importance of interruption.

Chapter 4: A detailed look at the setting and methodology of the thesis. The process of volunteer recruitment, data collection and equipment used for the observations of communication within the ICU ward round. Important definitions will be explained and the statistical software discussed.

Chapter 5: The statistical results. This chapter is broken down into seven main sections: (a) overview, (b) communication patterns, (c) communication channels (d) interruptions, (e) turn-taking interruptions, (f) purpose of communication and (g) purpose of interruption. Tables and graphs will demonstrate the differences of the healthcare staff with respect to the above categories.

Chapter 6: The limitations of the study are considered. Each section of chapter five results will be discussed and interpreted. The argument of interruptive communication and medical error will be proposed. Furthermore, how interruptive communication may translate into medical error and therefore poor patient outcomes.

Chapter 7: Concluding comments on the importance of communication and suggestions for further research.

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1. Alvarez, G; Coiera, E.

Interruptive communication patterns in the intensive care unit ward round.

International Journal of Medical Informatics.

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2. Poster presentation: Toronto Critical Care annual meeting, October 2003.

Alvarez G, Spencer R, Nguyen K, Coiera E.

Interruptive communication patterns among healthcare staff in an Australian intensive care unit.

CHAPTER 2 - ERROR IN MEDICINE

Medical error and patient safety have become important issues. The media and general population have also begun to recognize the importance of medical error since the release of the Institute of Medicine report, “To Err is Human” (17). Extrapolating from previous studies (18;19), the report stated that medical error was the eighth leading cause of death among Americans! However, interest in medical error began long before this year 2000 publication.

Perhaps one of the earliest papers looking at medical error was published over 25 years ago (20). These authors looked prospectively at all ICU admissions over one year at a single centre. They discovered that 41 (13%) of the 325 admissions were because of iatrogenic disease. Iatrogenic complications were fatal in eight cases and life threatening in another thirteen. In 1991, The New England Journal of Medicine published two landmark studies that highlighted medical error and subsequently spawned a large amount of literature into adverse events within medicine (18;19). This was a retrospective study of New York State reviewing over 30 thousand discharges. An adverse event (AE) was defined as an injury that was caused by medical management and that prolonged the hospitalisation, produced disability at the time of discharge, or both. Negligence was defined as care that fell below the standard expected of physicians in their community. An AE occurred in 3.7% of hospitalisations and 27.6% of these AE were due to negligence; 2.6% of adverse events gave rise to a permanent disability, and 13.6% caused death. This estimate would equal 2550 patients with permanent disability and 13,400 patient deaths in 1984. Of note, 48% of adverse events were related to a surgical operation (defined as within 2 weeks) and the second most common adverse event was drug related. Limitations of this study included:

- (a) Exclusive use of retrospective chart review, which fails to provide evidence or insight into the specific causes of an adverse event,
- (b) Absence of explicit criteria used to identify an adverse event,
- (c) Not using a trained specialist to review the charts and
- (d) Poor inter-observer reliability regarding negligence ($\kappa=0.24$), and adverse events ($\kappa=0.61$).

Thomas *et al.* then performed a study with similar methodology to the Harvard Medical Practice Study (21;22). These authors randomly sampled fifteen thousand non-psychiatric discharges from Utah and Colorado. The study's highlights included an annual adverse event rate of 2.9% and that 30% of the adverse events were due to negligent care. Death occurred in 6.6% of adverse events and 8.8% of negligent adverse events. Among all surgical adverse events, 5.6% resulted in death, accounting for 12.2% of all hospital death in Utah and Colorado. A more recent British study showed that 10.8% of their patients experience an adverse event (23).

The Southern Hemisphere took note of these apparently alarming figures and conducted a study of their own (24). The Quality in Australian Health Care Study retrospectively reviewed over fourteen thousand admissions to 28 hospitals comprising nearly half of Australia's population. They defined an adverse event (AE) as an unintended injury or complication, which results in disability, death or prolonged hospital stay and is caused by health care management. The main findings were that 16.6% (CI 15.2-17.9) of admissions were associated with an AE and that 51% of AE were judged to be preventable. Adverse events accounted on average of 7.1 additional days in hospital and 13.7% of AE (CI 12.2-15.2) resulted in permanent disability while 4.9% of AE (CI 3.8-6.0) resulted in death. The conclusion that an adverse event caused death requires a note of caution. Many of these patients were elderly (80% older than 65 years) and had a serious

underlying disease, which severely shortened their life expectancy independent of any adverse event. The authors in this study appreciated that raw numbers (especially collected retrospectively) can be misleading and that “human error” is a difficult and complex definition. Therefore, the reviewers were asked to record, if possible, the type of human error that may have contributed to each adverse event. In 74% of cases, however, the reviewers did not record any opinions as to what type of human error, if any, may be involved. The paper concludes cautiously by pointing out that half of all adverse events were deemed to have low or no preventability, and therefore, the public and legal system should be aware as to avoid inappropriate litigation. One of the authors, Wilson, several years later echoes his concern and asks readers to recognise that human error is inevitable despite all the best training (25).

The acme of public scrutiny was crystallised with the Institute of Medicine releasing its headline-grabbing report, “To Err is Human” (17). Extrapolating from the New York and Utah/Colorado studies, the report stated that death due to medical error is the eighth leading cause of death among Americans. Medical adverse events cause between 44,000 to 98,000 deaths and cost the USA nearly 50 billion dollars a year. Despite the flaws in the original studies, the fact that we don’t have a denominator (i.e., the incidence of adverse events) and authors cautioning the interpretation of this report (13;26-28), the Institute of Medicine’s report has propelled the subject of medical error into the limelight, and therefore, the political arena. Former President, Bill Clinton, under the auspices of the President’s Advisory Commission on Consumer Protection and Quality in the HealthCare Industry along with the Quality Interagency Coordination Task Force (QuIC), formed the National Quality Forum (NQF) in patient safety. The NQF’s mission statement reads: “To increase the provision of high quality healthcare. More specifically, to promote delivery of healthcare known to be effective, care known to achieve better health outcomes, greater patient functionality, and a higher level of patient safety” (29). The NQF’s consensus statement has many

recommendations, which when looked at closely, clearly advocate system solutions and concede that physicians make mistakes (30). Similar taskforces have subsequently been established and charged with improving healthcare delivery in their countries (31;32).

Before the IOM's controversial report was published, the field of medicine had long started to look at ways of reducing error. Insight towards system change had not always existed. At first, medicine's focus appeared to be on the identification of error (33-35). However, the medical community soon realised the limitations of the detection of error without contextual data. Incident monitoring is not concerned with the statistical rates but the continuous collection of more detailed contextual information about the specific processes, systems and actions that lead to adverse patient outcomes (36-39). Overall, incident monitoring studies use anonymity as a safety net to encourage the open discussion of error and their causes. Although incident monitoring studies conclude that most adverse events are preventable, they also state that the majority of error has a systemic contribution. Poor or inadequate communication is often cited as one of the more important liable contributing factors. Authors like Wolfe et al. have shown that the rate of adverse events can be reduced using a systems approach to event analysis, followed by appropriate action and continued monitoring for adverse events to evaluate the effectiveness of the intervention (40-42). A recent review provides further evidence about a clinician's ability to identify and therefore reduce medical errors (43).

One of the more impressive attempts to improve quality care using incident monitoring comes from Australia (44;45). The aim of the project was to develop and evaluate a tool to systematically identify and analyze adverse events in the intensive care unit in hopes of elucidating the underlying causes. As noted by others (46;47), a voluntary, anonymous methodology empowers all staff to participate and overcomes intrinsic shyness or fear of criticizing senior staff. Over two months in

three Intensive Care Units (ICU), 129 incidents were recorded, of which 116 (87%) had an evaluation questionnaire completed. In eighty five percent of incidents, no harm came to the patient. Of the remaining 15% of incidents, only 2% were considered major and all incidents were temporary in nature. Of all the “contributing factors” cited, the most frequently chosen were errors of communication. Since this study, many other papers on incidents monitoring in both pediatric and adult ICU’s have been published (48-53). Unfortunately, all these studies share weaknesses. The major disadvantage of anonymous incident monitoring is that it does not accurately provide a numerator or a denominator thereby shedding little light on the prevalence and incidence of adverse events. Other concerns include:

- (a) It takes enthusiasm and repeated prompting to get staff to fill in incident reports,
- (b) Reports need to be filled out as soon as possible after event to avoid distortion,
- (c) Reluctance to fill out forms because of the fear of litigation and the perception of sub-standard level of care.

Notwithstanding these problems, many people agree that critical incident reporting should be routine in all ICUs as part of a policy of continuous improvement of quality (54-56).

In order to understand the problem, one needs to first define it. To that end, efficient and routine identification of error needs to be part of “normal” hospital practice. Dr. Leape agrees and uses the aviation industry’s attitude towards error to highlight where medicine can begin (1). First, aircraft designers know error and failures are inevitable and design systems that can absorb them, building in buffers, automation and redundancy. Medicine has traditionally relied on the healthcare system *not* to commit error rather than assume it will. Medicine believes that error can be eliminated if doctors are sufficiently vigilant and conscientious. The truth is that attentive doctors make mistakes, even in tasks at which they are highly skilled. Second, procedures are standardised to the maximum extent possible. With exception of the operating room, standardisation is rare and

physicians continue to rely on short-term memory to perform tasks. Third, the training, examination, and certification process is well developed and enforced. Few will deny the extent and breadth of knowledge that a doctor needs to learn. However, until recently, little emphasis has been placed on re-certification. Finally, safety in aviation has been institutionalised. In contrast, the medical field tends to rely on morbidity and mortality rounds, peer review and case studies to discuss error. These traditional methods have a narrow focus on individual performance to the exclusion of contributory team issues. They tend to search for error as opposed to error reduction and generally lack a multi-disciplinary approach. The truth is that medical error occurs within the complexity of a healthcare system, the occurrence of error is hard to predict and can never be eliminated completely. Other authors have also looked to non-medical domains to provide direction for the medical community (46;57-60).

Fortunately, there is a growing understanding that the focus has to shift away from the behaviour of individuals towards the environment (61-70). Countermeasures are based on the assumption that though we cannot change the human condition, we can change conditions under which humans work. Pietro put it nicely: “Expecting perfection is foolish; we must move away from this false and unattainable standard. If we don’t accept the inevitability of our errors and those of everyone on the healthcare team we cannot honestly put patients first. We also risk becoming the villains in the growing patient safety movement instead of leaders in it” (71).

CHAPTER 3

A. Communication as latent source of medical error

What are these latent failures in medicine that predispose physicians to error and therefore possible patient harm? Many of the research articles discussed in Chapter two suggest that poor communication is a significant source of medical error. Unfortunately, these articles do not provide an adequate definition or attempt to quantify communication as meeting minimal criteria for “effective”. In 1967, Stein discusses the *doctor-nurse game* and how subtle communication from the nurse was important to patient well-being (72). Dr. Stein cites “open communication” between doctors and nurses as a pivotal step but fails to elaborate on what that is and how it should be achieved?

Abramson and co-authors suggested that 15% of human error in their ICU was attributable to communication problems (33). The Harvard Study (18), the Australian Study (24) and the Institute of Medicine report (17) all reveal that ineffective communication is a significant factor in medical error. Papers in family practice (73;74) emergency medicine (38;75-77), anaesthesia (78), and the intensive care unit (44) all make pleas for better team communication. In fact, the AIMS-ICU study showed that communication was a leading “contributing factor” in preventable adverse events (45). Vincent *et al*, in trying to provide a framework for safety in clinical medicine, describes the team dynamic as a possible source of latent error (16). The way an individual’s practice impacts on the patient is influenced by the way other members of the team communicate with each other. In a recent survey, over 80% of medical staff reported that the pre-operative and post-operative discussions are an important part of safety and teamwork (79). The most vital recommendation from people working in the operating theatre was to improve communication. The authors concluded that future research should focus on effective teamwork and

communication. Another study of operating room staff showed that young physicians adopt the maladaptive communication style of their mentors leading to further tension among the staff (80). Communication was cited as the most important contributing factor in a study investigating the medical resident's perspective of medical mishaps (81). Intriguingly, communication failures were viewed as far more complex than the simple exchange of information. The failures related to hierarchical differences, concerns with upward influence and interpersonal power and conflict.

Despite an apparent need to investigate what constitutes good communication between healthcare workers, and, mounting evidence that physician-nurse collaboration improves patient outcomes (82-85), little has been done in this field. It is of interest to note that physicians and nurses view their communication skills differently. One study examined the perspectives of nurses and physicians on collaborative interaction using a modified 5-point Likert-type questionnaire (86). This scale attempted to examine the extent to which nurses and physicians perceive what they can say and what they mean when speaking with one another. Physicians had significantly higher perceptions than did nurses of communication openness, timeliness and satisfaction with overall communication. These findings suggest that physicians may have less fear of repercussion or misunderstanding when speaking with nurses than nurses did when speaking with physicians. A more recent study shows that nurses and doctors have clear differences in their perceptions of satisfactory collaboration and communication (87). Lynee Doering, a registered nurse, provides some insight regarding good communication skills in today's medical climate (88). "The recent economic turmoil has forced many experienced nurses into other employment settings and many hospitals are again resorting to casual labour pools, such as traveling nurses and outside agency nurses. Clinicians and nurses find themselves working in environments that are not as familiar as they once were. This development places even greater importance on good communication skills to adequately interact with strangers."

A recent trend in the ICU literature has been to discuss communication skills (87;89;90). Critical care physicians, by the nature of their patients, spend much of their clinical time speaking with patient's families. Most families rate clinicians' communication skills, along with accessibility, as more important than their clinical skills (91). Medical schools ration little curriculum time towards teaching communication skills; the emphasis is placed on medical knowledge and clinical competence (3;4;92). Two recent Canadian studies underscore the difficulties but successes in attempting to incorporate communication teaching into residency programs (93;94).

Studies investigating the adequacy of physician communication skills with families of the critically ill have been disappointing (95-97), although a recent study in France has been more favorable (98). The largest study (SUPPORT trial) to focus on communication between physicians and patients took place in the United States of America (99). A phase I study took place over two years with 4301 patients at five teaching hospitals and identified a substantial shortcoming in communication. The phase II intervention was aimed to improve communication and decision making by providing prognostic information, eliciting patient and family preferences, and their understanding of disease prognosis and treatment. Also, they provided a skilled nurse to help carry out the needed discussions, convene meetings, and bring to bear the relevant information. Major outcomes of concern were: (a) median time until DNR (do not resuscitate) was written, (b) DNR agreement between patients and physicians, (c) patient in an undesirable state, (d) patient experiencing pain, and (e) resources used. Unfortunately, there was no difference in all the major outcomes between patients in phase I or phase II and between the patients in phase II randomized to either control or intervention.

Not all trials on interventions to improve communication have been so disappointingly negative. Lilly *et al.* reported a study with a three-month pre-intervention period followed by a nine-month intervention (intensive communication) period (100). In the intensive communication period, they introduced an initial formal multi-disciplinary meeting with the patient, family or both within 72 hours of admission. The timing of subsequent formal meetings was set by “clinical milestones” the patient had or had not reached and by the ability of patient/family to process medical facts. During the intervention period, the rate of provider non-consensus days decreased from 65 days per 1,000 patient days to 4 days per 1,000 patient days. Similarly, the rate of family non-consensus with health care team decreased from 171 to 16 days per 1,000 patient days. The risk of remaining in the ICU was significantly less in the intensive communication group after adjusting for APACHE III scores (risk ratio 0.81, CI 0.66-0.99, P=0.04). There was a trend towards reduced mortality (p=0.06); this was not a result of an increased rate of transfer of dying patients from the ICU. Interestingly, one study suggested that families were more content *not* to participate in decision-making with regards to their critically ill family members (101). Unfortunately, although the critical care literature considers communication between physicians and patients and their families, little attention is given to the doctor-nurse conversation.

Why is studying communication in the Intensive Care Unit (ICU) important? In many aspects, communication is at the centre of all ICU activity, linking culture, leadership, coordination, and the ability to solve problems [Figure 3.1, adapted from Spencer *et al.* (102)]. Few clinicians would argue that the ICU is a stressful place to work and that the sickest patients reside within the ICU. Eisendrath and co-workers prospectively studied medical officers in an ICU and asked them to compare their stress level to other non-ICU rotations (103). Not surprisingly, the 26 physicians rated the ICU more stressful. When asked how they coped with stress, talking with other house

staff ranked only second to humour. The complexity of the multi-organ physiology combined with the sophisticated technology can be overwhelming to physicians entering the ICU for the first time. An established (yet often overlooked) finding in stress research is that as stress or arousal increases, an individual's thought processes and breadth of attention narrows (79). In addition, the complexity of a system is an important determinant of the likelihood of error (104). Mistakes are more common when the clinician is inexperienced and when new techniques are introduced (105-108). Among paediatric patients admitted to a British hospital, drug errors were seven times more likely to occur in the ICU than elsewhere (109). Furthermore, more drug errors occurred in this paediatric ICU when new doctors joined the rotation. The Harvard investigators found that adverse drug events occurred more often in medical or surgical

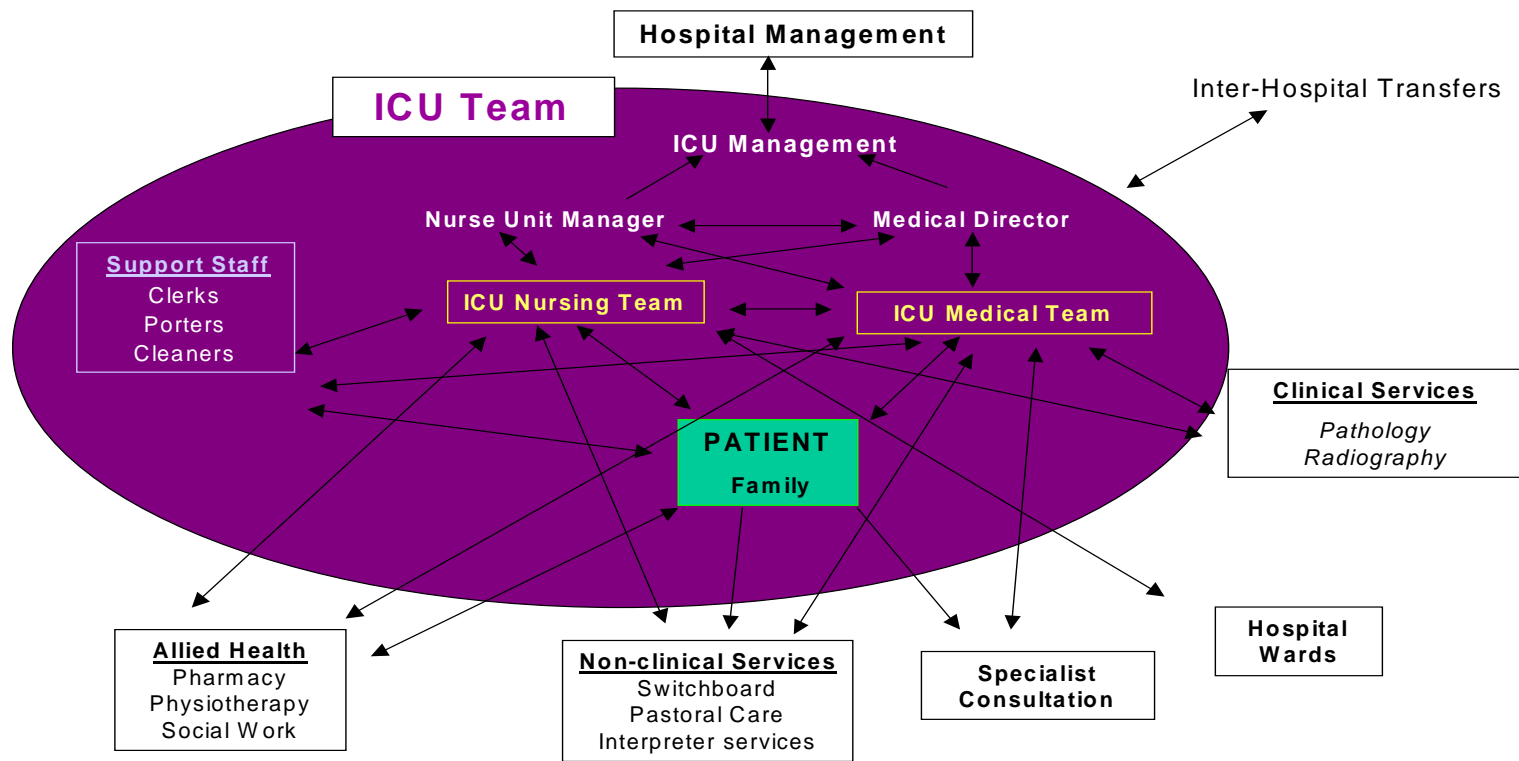


Figure 3.1: Communication flow in the ICU may be complex

ICUs compared to either general medical or surgical wards (18). Similarly, the Australian Healthcare Study showed that a greater risk of death and adverse events was associated with patient complexity, illnesses requiring urgent care, and the use of interventions thought to be potentially life saving (24).

Qualitative research techniques appear to be particularly useful when problems are complex, contextual and influenced by the interaction of physical, psychological and social factors. Zimmerman *et al.* agree and advise that greater emphasis must be placed on direct observation when studying the intensive care unit (110). Donchin and associates studied an Israel ICU over four months in the hope of investigating the nature and causes of human error (111). A physician or nurse filled out an error report as an error was discovered. A twenty-four hour continuous bedside observation conducted on a randomly selected group of 46 patients generated activity profiles. Each single interaction, regardless of time required, was counted as a single interaction. There were 8,178 activities (178 per patient per day) during the activity profile. Verbal communication was observed in only in 291 (9%) activities. Most communications were exclusively among physicians or exclusively among nurses. Only in 60 (2%) of the recorded activities did doctors communicate verbally with nurses! Verbal communication between physicians and nurses was observed in 205 (37%) of the error reports. This is surprisingly high, when contrasted with the finding that verbal communication between nurses and physicians was observed only in 2% of activities. The authors cautioned the interpretation of these results because it was a single centre trial and had no “control”. Nevertheless, these results clearly stress the importance (and lack) of good communication for the transfer of information between doctors and nurses, and, the consequent over-representation of communication events in medical error.

In order to understand how communication may affect the systemic component to human error, one needs to first understand what kind of communication is happening.

Is there a pattern or preferred method of conversation between doctors and nurses?

More importantly, can one identify and therefore finally define what poor or undesirable communication means? Coiera *et al.* performed an exploratory study to identify patterns of communication behavior among hospital based healthcare workers (112). His study followed eight physicians and two nurses around a general medical ward in the United Kingdom. The study identified 96 call events, defined as an attempted use of the telephone or paging system. However, a person was successfully connected only 74% of the time. Consultants were involved in almost no call events, while junior doctors bore the brunt of calls received. The study specifically looked at communication between nurses and doctors and found that nurses initiated 16 out of 20 events. There were also inefficiencies with team communication. For example, one senior medical registrar made 8 telephone calls (three failed to connect) and 1 page over 54 minutes to arrange one CT-scan. Of interest, there was a bias towards synchronous communication, that is, immediate contact with another person. Perhaps most importantly, observed participants did not seem to judge the consequences of their interruptive style of communication. Medical staff were driven by tasks presented to them and seemed compelled to “ tick off ” tasks on their mental checklist. Because of the results of this study, Coiera *et al.* suspected that communication loads were a likely source of latent error for physicians. The authors later repeated a similar study to try to understand the mix of communication and information choices available to clinicians (113). They found that clinicians spent over 80% of the observed time in communication acts! Thirty percent of all communication events were considered interruptive and 10% of communication time involved multi-tasking. There was again a bias towards synchronous conversation. This is in contrast to asynchronous communication like e-mail, notes or voice message. Eight-eight percent

of all events involved the use of a synchronous channel, and face-to-face dominated, accounting for 82% of all events.

B. Interruptions within a conversation

Since communication between health care workers may be a latent source of medical error, a closer look at the constructs of a conversation is needed. Although much has been written regarding the construction, systematics and “rules” of verbal communication (114-116), the notion of interruption deserves special focus. Roger *et al.* have developed a speech coding system and provide a practical definition of a conversational interruption (117). An interruption is successful if two criteria are met:

- (a) The interrupter does not allow the other speaker to finish his/her utterance, and
- (b) The interrupter was able to finish his/her utterance.

Simultaneous speech refers to when two or more people are talking at the same time and is an example of an unsuccessful interruption. In contrast, an interruption actually stops another speaker’s utterance. However, not all-simultaneous speech is necessarily disruptive. Verbal phrases like “yeah”, “uh-huh” and non-verbal cues like head nodding and smiling often happen concurrently with the speaker. They, however, signal listener attention and not interference (117).

There has been speculation that interruptions within verbal conversation are related to the gender and the personality of a speaker. Natale’s study of 72 University students found a significant negative correlation between interruption rate and a speaker’s self-described anxiety (118). A person’s desire for social approval had a positive relation to interruptive behavior. Contrary to previous writings (119;120), males did not engage in more interruptions than females. Robinson and Reis provide some insight into how a person views interruption and personality traits (121). Interrupters, regardless of sex, were seen as less sociable, perceived as more assertive and less feminine than those who did not interrupt. In addition, there were penalties for allowing oneself to be interrupted, including receiving higher ratings on submissiveness and emotional vulnerability

scores. An earlier study could find no correlation between traditionally dominant personality characteristics and the rates of interruption in free speech (122). However, all participants in the study were female making this work less generalizable.

Interruptions within conversations have been looked at with respect to the physician-patient interaction (123;124). A 1984 article studied the linguistic structure of the opening segment of the patient-doctor encounter in an internal medicine clinic, involving two faculty Internists and thirteen training residents (125). Although all of the *non*-interrupted opening statements by patients were completed, only 1 of 52 interrupted opening statements was subsequently completed! Overall, patients were allowed to complete their initial statements in only 23% of the visits. Interruption occurred, on average, 18 seconds after the patient began to speak. An observational study of general practice and internal medicine residents found similar results—patients spoke an average of 12 seconds before being interrupted (126). Rhoades *et al.* audio taped clinical encounters in the emergency department and found that only 20% of patients completed their presenting complaint without interruption; average time to interruption was also 12 seconds (127). Irish and Hall videotaped 100 medical visits to determine whether physicians verbally dominate their patients (128). A second goal was to establish if a physician's level of experience plays a role in the physician-patient conversation. Against the predictions, physician and patients tended to have similar frequencies of successful interruptions. High status physicians did not interrupt or overlap their patients' more than low status physicians. This in contrast to a previous study that showed senior trainees interrupted their patients less frequently than junior residents (126).

One interesting study looked at the patient's perspective on physician interruption during a consultation (129). Twenty percent of patients rated the interruption as having a "bad effect" and 40% felt that it would have been better not to be interrupted. In addition, 52% of patients felt that

the reason for the interruption was not important. A Middle Eastern study also showed the negative perceptions of interruptions during a medical encounter (130). Eighty-four percent of the physicians expressed the opinion that interruptions during consultations were harmful and disruptive and 92% felt that this had a negative influence on patient-doctor relationships. Seventy percent of the patients were annoyed with the interruption and only 40% of the patients felt that their physician had given them undivided attention. Other studies show that nurses get interrupted more often than physicians (131), and there appears to be little success with intervention programs aimed at reducing interruption rates (132). The above-mentioned literature focuses on interpersonal communication but fails to investigate the consequences of this interruptive style of communication.

Kirmeyer was the first investigator to use an observation method to document how interruption in the workplace could be a source of *cognitive overload* (133). This paper studied externally imposed interruptions on police radio dispatchers and examined their *subjective* workload. As interruptions increased, subjects appraised their workload as overloading, and consequently, spent more of their time to decrease the duration and number of interruptions. Kirmeyer conceptualizes an “interruption as an uncontrollable and unpredictable stressor that results in information and cognitive fatigue. Increased attentional demand may occur because effort is required to evaluate the significance and decide on appropriate responses to multiple, concurrent inputs. When interruption causes employee to leave tasks unfinished, these tasks act as distracters and further effort is required to inhibit attention to them while processing new inputs. One way of coping with depleted attentional reserves is to set priorities for use of attention, giving priority to information pertinent to one’s own goals and neglecting cues that carry information.”

Chrisholm *et al.* performed an observational study of thirty certified ER physicians also focusing on interruptions in the medical workspace (134). An interruption was defined as any event that briefly required the attention of the subject but did not result in switching to a new task. A break in task was defined as an event that not only required the attention of the physician, but subsequently resulting in changing tasks. Results showed that the mean number of interruptions per hour was 10.0 ± 3.2 and the mean number of break in tasks per hour was 6.9 ± 2.1 . The average number of patients simultaneously under a subject's care was 5.1 ± 2.1 , with a range of 0-12. Although the authors worry that emergency doctors may be "interrupt-driven and multi-tasking", they concede that like stress, not all interruptions are necessarily bad, unwanted or unproductive. In fact, interruptions alert clinicians to priority or dangerous conditions that demand their immediate attention. The danger is when the number of interruptions cripples the physician's ability to prioritize incoming information. Chrisholm *et al.* performed a follow-up study comparing emergency doctors with primary care physicians (135). Using the same definitions for interruptions and break in task, they demonstrated that emergency doctors were interrupted three times more often than their primary care counterparts. Although primary care doctors managed one patient 59% of the time, emergency doctors managed a single patient only 16% of the time. An imperative for task prioritization and rapidly shifting work demands is likely a major difference between emergency and primary care medicine.

CHAPTER 4

A. Purpose

Communication is pervasive in all aspects of life. As argued in the previous three chapters, one of the more important aspects of medical error is accepting the fallibility of the individual and looking for the system processes that predispose that individual to committing an error.

One aspect of the system that appears important in the medical community is the communication space. In particular, is there a pattern of communication among health professionals that predisposes them to making unwanted errors? The emerging evidence suggests that there exists a significant amount of interruptive communication in the health domain, and that this may lead to otherwise avoidable mishap and error.

The communication flow between intensive care staff has never been studied with respect to interruptions. It is hypothesized that within this very intense medical environment, there will exist a significant amount of communication interruption. In addition, are there different types of interruptions that occur within a conversation? Will different intensive care staff commit or suffer differently from these types of interruptions? What are the consequences of communication interruption and most importantly, could they impact the delivery of healthcare towards the patient?

In order to document if this phenomenon exists, an observational technique will be used where different members of the intensive care staff will be closely followed. All communication flow between that member and the rest of his/her environment will be documented with special focus of interruptions.

B. Setting

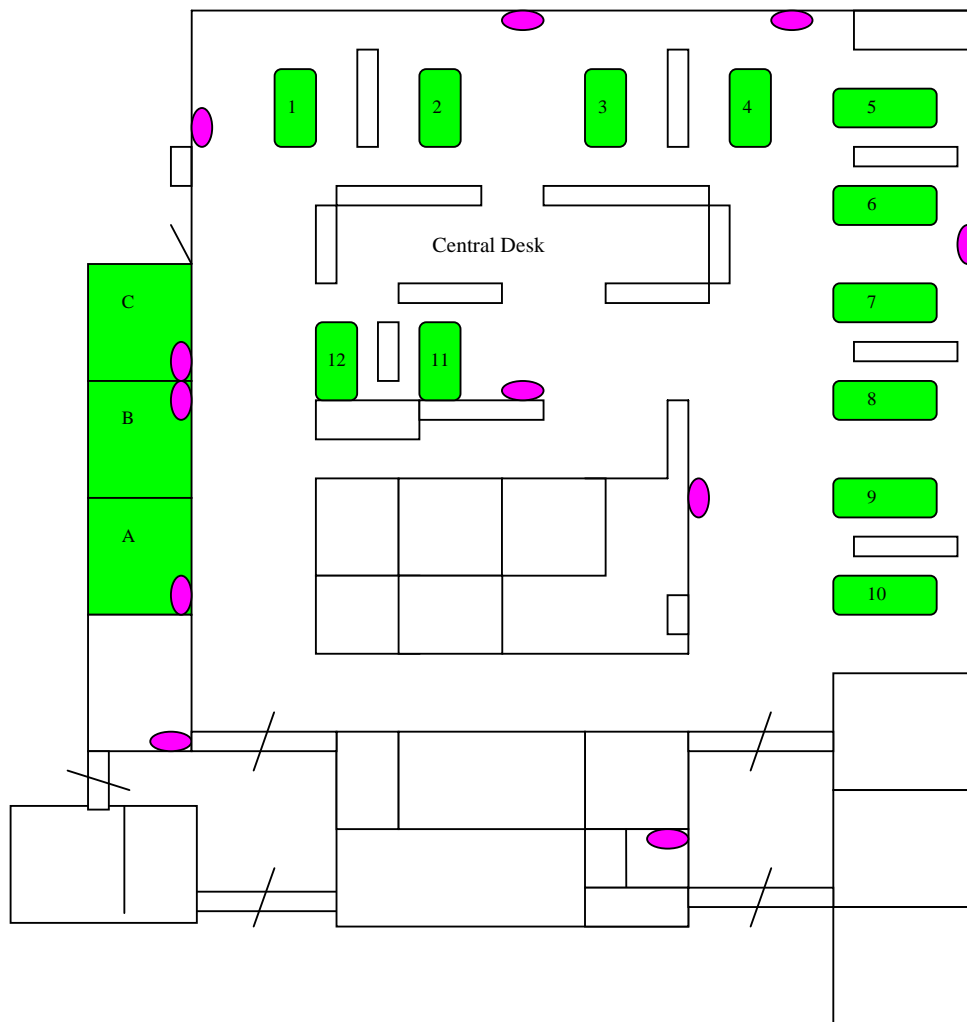
The study was performed in a large metropolitan teaching hospital located in Sydney, NSW, Australia. The hospital is a trauma center with over 500 hospital beds and 12 intensive care beds. The Intensive care unit (ICU) operates 24 hours a day, 365 days a year with continuous “in house” doctor coverage. The number of patient admissions into the ICU over the three-year period, 2000 to 2002, averaged 795 per year. The ICU is staffed by five intensive care consultants, seventy nurses and a complement of senior registrars, junior registrars and residents (see definitions). Because the hospital is a teaching center, junior registrars and residents “rotate” through the ICU as part of their training, typically 3 to 6 month rotations. Senior registrars are employed for an entire academic year.

All observations occurred during the daily morning or evening ward rounds. This time was chosen because it typically represents the busiest times of the day where all patients are examined and management decisions are made. The observations occurred between June/2002 and February/2003. During the daily rounds, a team of four or five physicians move from patient to patient deciding on the daily plan for each patient. The unit is considered “closed” in terms of all patient decisions are coordinated via the ICU team. This is opposed to older “open” ICU model where patients were admitted under different doctors instead of a dedicated team. Typically, there is one nurse per patient. During the observations, a nurse unit manager and charge nurse was in the ICU at all times (see definitions).

The physical layout of the ICU is schematically represented in Figure 4.1. The ICU has only two entrances whereby both hospital staff and patient's family can enter. A ward clerk resides at the central station where there are four telephones and all of the paper documentation exists. The central desk is the hub of activity where patient care is coordinated. For example, investigations are ordered, porters are paged and discussions with consultants are had. A whiteboard is situated at the central desk that identify which staff are currently in the ICU (and their pager numbers), patient demographics and where patients are located if they are outside the ICU.

There is a computer located at each bedside that has access to the local intranet in order to look up patient results. Nurses and doctors type their daily notes into the computer as an attempt to move away from paper documentation. However, there continues to be a standard paper medical chart for legal purposes. Consequently, a large repository of data exists at each bedside.

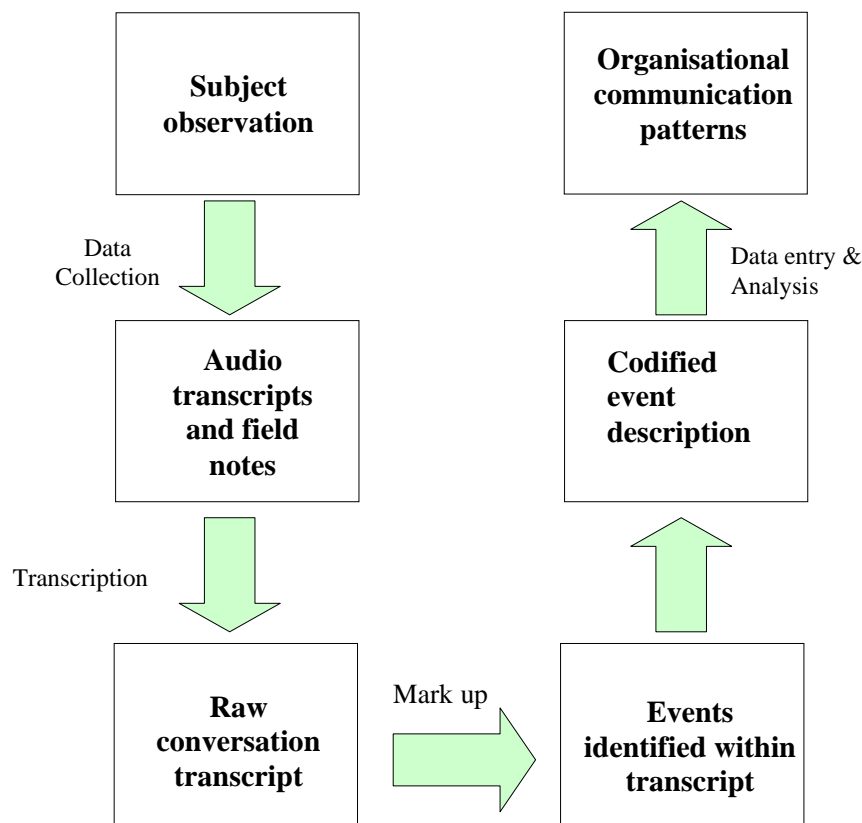
Figure 4.1: Schematic layout of the Intensive Care Unit.
Green color demonstrates the positions of the beds within the ICU.



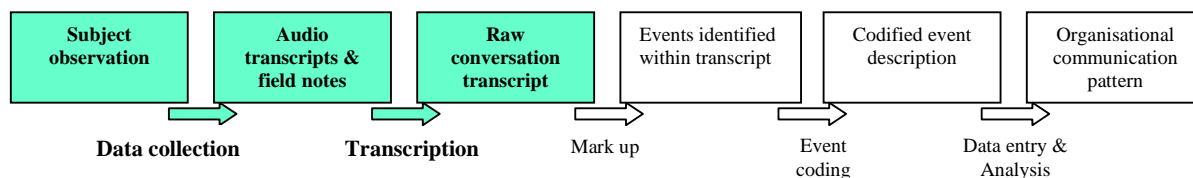
C. Methodology

The method, known as the Communication Observation Method (COM), is based on the work developed by researchers at the Centre for Health Informatics, University of New South Wales, Sydney, Australia (136-138). A full version is available at www.chi.unsw.edu.au. The Communication Observation Method (COM) aims to measure the communication patterns and choices of individuals within clinical environments. Data is collected through direct observation of the routine work of participants. Figure 4.2 presents a summary of the COM, which will be described in the proceeding sections.

Figure 4.2: Summary of the Communication Observation Method (COM)
[reprinted with permission from Spencer et al. (136)]



1. Data collection and transcription



The South East Health Human Research Ethics Committee approved the study. All participants were current employed staff of the hospital's Intensive Care Unit (ICU). Prior to the recruitment, the researcher was in liaison with the medical director, clinical nurse educator and nurse unit manager to facilitate dissemination of information. Nurses and physicians volunteered to have their communication patterns observed.

Several formal presentations were conducted with ICU staff to introduce the rationale for the study, answer questions and discuss any potential concerns regarding the methodology. Posted reminders asking for participants to contact the researcher followed these presentations. All subjects were self-referred volunteers. Prior to the observation, each subject was given a detailed information statement about the study (Appendix 1). The information sheet provided a full explanation of the study, reinforces the confidentiality of the data and the subject's right to withdraw from the study at any time. This was accompanied by a verbal explanation of how the observation will be organised including the equipment set-up as well as reiterating the recording protocol. The importance of the subject interacting as normally as possible with other staff and patients was reinforced.

Confidential material may be captured using the COM. Subjects may be reluctant to participate in the study because of fears of breaching patient confidentiality or that recordings may be used in the future as evidence in legal proceedings. Consequently, the study protocol vested ownership of the recordings (and any transcripts) to the observed subject and their institution. Thus, participants were able to suspend recording or retrospectively exclude recorded material. Because the subject's microphone would record conversations with other staff members and with patients, the subjects were asked to obtain verbal consent from their patients, informing them that their conversation will be recorded. The patient/staff could request the suspension of the recording at any time. There were also some circumstances when the patient was unable to give informed consent. In that case, it was stressed that the subject had full control regarding stopping the recording if, in their clinical judgement, they feel the situation is not appropriate. Recordings could also be suspended for personal reasons, for example, phone calls and 'food' or 'toilet' breaks. If for any reason the clinician is unable to suspend recording, the observer was able to do so if deemed to be appropriate. At the end of each observation, there was a brief interview where the subject could voice concerns and the researcher could ask any questions.

EQUIPMENT

During the observation, the researcher “shadowed” the subject following them as they carried out their routine duties. The researcher followed at a distance to avoid direct interference with normal work, but remains sufficiently close to observe what was occurring.

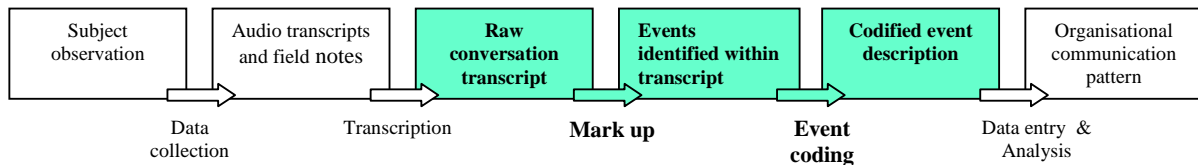
Researcher equipment: The researcher carried a notepad, pen, stopwatch, the recording device and radio receiver, as well as wearing headphones that were plugged into the recorder. Listening through the headphones enabled the researcher to hear the conversation of the participant at all times and additionally confirm the effective functioning of the equipment. (See Appendix 2 for picture of equipment).

Subject Equipment: Participant clinicians wore a lapel microphone and carried a radio transmitter, through which conversations with patients and other staff members was transmitted to the recording device carried by the researcher. (See Appendix 3 for picture of equipment). The subject’s conversations were recorded, and the observer made field notes that described the flow of events as well as other environmental influences.

Field notes: During the observation period the observer made field notes in addition to the recording. Field notes are a crucial part of the data collection, capturing information that is not recorded on the audiotape, but which is needed to explain the recorded events. Field notes were recorded on a notepad.

The subject’s conversations were transcribed verbatim to produce a text record of the audio data. The field notes were incorporated into the text record.

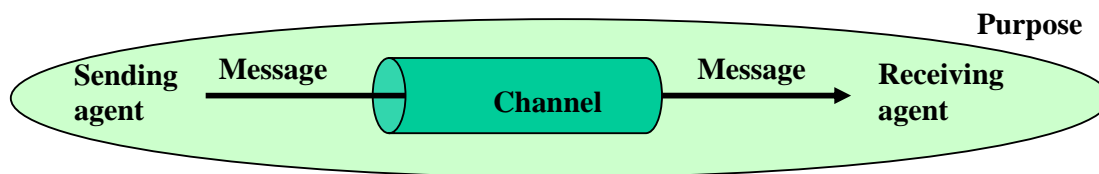
2. Mark up and coding transcriptions



When transcription was completed, each transcript was read through and cross-referenced with the field notes whilst listening to the recording. Each transcript was marked-up into a sequence of individual communication *events*, each representing a unique interaction between the observed subject and their environment.

A *communication event* was defined as the passing of information from one party to another across a communication channel

Figure 4.3: Communication event definition
[reprinted with permission from Spencer *et al.* (136)]



Examples of communication events include face-to-face discussion, telephone conversation or entry of text into a medical record. While the concept of an event seems discrete, rules were employed to have consistent coding. A new event occurs either when:

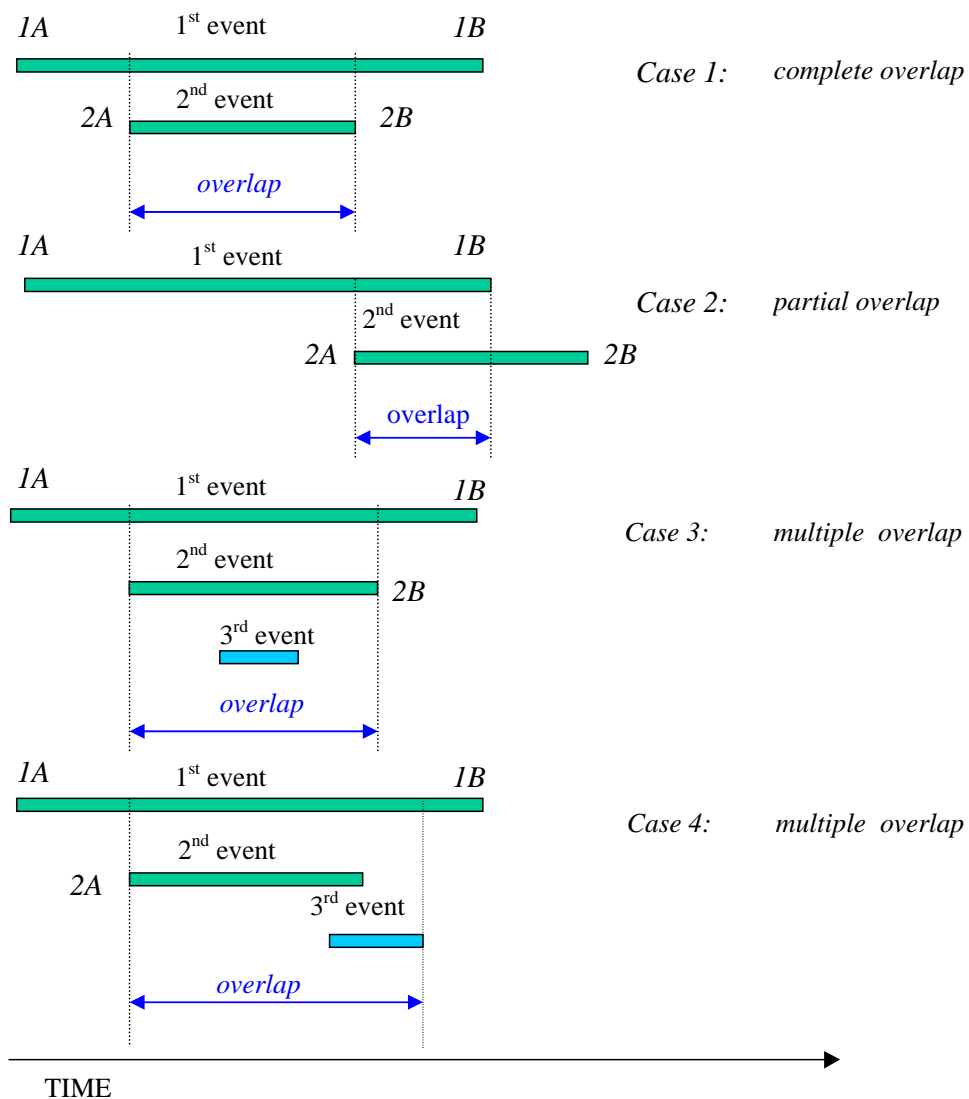
1. A communication act starts in an event free period.
2. During a period of communication, there is a change in the purpose, channel or participants.

A communication event terminates when:

1. The end of communication is obvious, for example, an observed volunteer says goodbye or leaves the ICU.
2. When the end of one event is immediately followed by a new event.
3. When the participant is no longer committed to the purpose.

Communication multitasking occurred when a subject experienced two or more overlapping communication events at one time

Figure 4.4: Examples of communication multitasking
[adapted with permission from Spencer *et al.* (136)]



The flow of control within a conversation can be visualised as two or more people passing around a *baton*. The person who is speaking is holding the baton. The other members of the conversation are waiting for the chance to be given the baton or forcible take the baton. The passing around of the baton is the natural ebb and flow of a dialogue while the premature seizing of the baton is an interruption. Therefore, an interruption can be visualized as the disturbance in the flow of control within a conversation.

From the perspective of an individual, communication is either initiated or received. Initiated conversations are voluntary, premeditated and likely not disruptive to that individual's environment or thought processes. Conversely, one can imagine that received communication may be disruptive and therefore negatively influence an individual's thought progression. I will divide interruptions into two main categories:

- (1) A *conversation-initiating interruption (CII)* is a communication event that is not initiated by the observed subject, and occurs using a synchronous communication channel such as face-to-face conversation or the telephone. In contrast, non-interruptive or asynchronous channels include e-mail, voice-mail or a paper note.
- (2) This study extended the COM to measure *turn-taking interruptions (TTI)*, when one individual begins speaking before the other finishes. To exclude simultaneous talk, two criteria needed to be met for a turn-taking interruption to occur (**Box 4.1**):
 - (a) The interrupter does not allow the other speaker to finish his/her utterance, and
 - (b) The interrupter was able to finish or continue his/her utterance.

1. Nurse:	Can you come over here and look at Mrs. “Y”, she dropped her blood pressure and I’m not sure why? (Calling across the unit)
2. Senior Registrar:	OK, just give me a second while I finish here. (Pause, talking across the room) Have you given her any albumin because she....
3. Nurse:	Already gave her 500mls but she hasn’t responded!
4. Senior Registrar:	Let me go look at her CT to make sure we haven’t missed anything and start some Noradrenaline...

Box 4.1: Example of a turn-taking interruption.

In utterance 3, the nurse prevents the senior registrar from completing their statement, and successfully makes a new utterance.

It is important to note that a turn-taking interruption is separate and distinct from a communication-initiating interruption. Conversation-initiated interruptions can be viewed as “inter” conversational interruptions while turn-taking interruptions can be viewed as “intra” conversational interruptions because they can only exist within the scope of an established conversation.

Once an *event* (whether communication or interruption) had been identified in the text, a set of attributes were used to describe each event:

- (1) Event identification number,
- (2) The start and end time,
- (3) The clinical role(s) involved in each event (**table 4.1**),
- (4) The communication channel used (**table 4.2**),
- (5) The purpose of the event (**table 4.3**),
- (6) If a conversation, whether initiated or defined as interruption,
- (7) If turn-taking interruption, whether initiated or received,
- (8) When two or more communication events occurred at once;
- (9) Any other relevant contextual information.

Table 4.1: Clinical role definitions. *

Intensive care consultant	A registered medical practitioner who is trained and qualified in the specialty of Intensive Care Medicine. The Joint Faculty of Intensive Care Medicine (JFCIM) governs the recognized qualification in Australasia. He or she is ultimately responsible for all decisions and provision of care of patients admitted to the intensive care unit.
Senior registrar	A registered medical practitioner working in the intensive care unit who is the final year(s) of his or her JFCIM qualifications. It is expected that a senior registrar will liaison closely with the consultant and make many independent decisions.
Junior registrar	A registered medical practitioner working in the intensive care unit who may have passed the “primary” examination in his/her chosen field of study, not necessarily JFCIM. Typically, a junior registrar has two or three years experience as a resident.
Resident	A registered medical practitioner who is in the second or subsequent year(s) of hospital clinical practice.
Nurse:	A registered nurse in the state of New South Wales
Charge nurse	A senior registered nurse responsible for coordinating the overall activities within the Intensive Care unit during each shift. Examples include bed allocation, staffing levels, and work breaks.
Nurse unit manager	A senior registered nurse who is responsible for administrative nursing issues. Examples include employing new staff, looking after rosters and settling staff conflicts.

* Other allied healthcare staff was captured in conversation but have not been explicitly given a definition. They include social work, pharmacist, physiotherapist, porter, ward clerk, X-ray technician, and medical/nursing student.

Table 4.2: Channel of communication event.

Face to Face	Paper source
Telephone	Email
Computer	Staff Communication book
Paper medical record	Pager

This is a not comprehensive list of all possible channels of communication for a clinical setting.

Others include fax, textbook, video conference, post-it note, etc. However, the participants in this study used a limited catalogue of channel options therefore a limited list is shown.

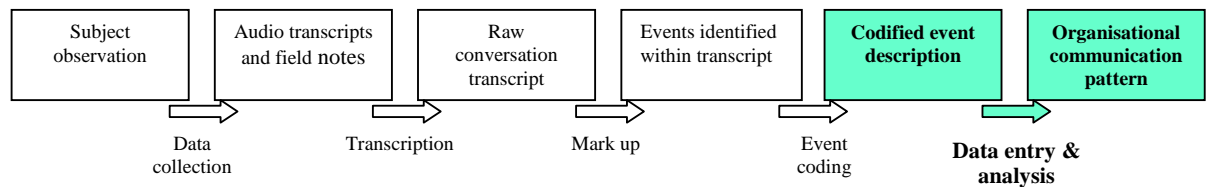
Table 4.3: Purpose of Communication event. **

Ward Round	This typically defines the daily meeting(s) of the entire medical staff when they review all their patients. This broad category encompasses all decisions regarding a patient including physical exam, changes in management and treatment choices.
Patient Management	Same as ward round but temporally outside of the “official” team round, that is after the ward round is finished. A doctor and a nurse’s patient management will differ because nurses have almost exclusive one-on-one patient interaction. Therefore, nursing examples also include the washing and turning of a patient, hourly vital signs, neurological exam, etc.
Organize Investigation	The process of getting additional specific patient information, for example, chest X-ray, CT- scan, blood work or echocardiogram.
Prescribe Medication	The giving or changing of medication to a patient.
Family Meeting	The organizing and actual conversation with a patient’s relatives. Includes updating on a patient’s progress and answering questions.
Consult	Being asked to see or assess a patient outside of the ICU. Includes requests for patient transfer from outside the ICU or hospital.
Procedure	Discussing, organizing or performing typical ICU procedure like intubation, central line insertion, arterial line, tracheostomy, Swan-Ganz catheter or verifying brain death.
X-ray Round	The viewing and discussion of patient X-rays. Usually in close relationship with the ward round.
Administrative/Clerical	Examples include documentation or filling out of paperwork, organizing of teaching sessions or getting a phone repaired.
Social	All conversations not directly related to the patient or working environment.

** Similar to Table 4.2, this is not intended to be an inclusive list of all possible purposes.

However, this final list was refined because of the author’s familiarization with intensive care unit tasks.

3. Data analysis



A Microsoft Access ® database developed at the Centre of Health Informatics was used for data entry (see figure 4.5).

Figure 4.5: Each screen in the database contains the information for a single event.

[Reproduced with permission from the Centre of Health Informatics ©, 2001-2005].

The screenshot shows the Microsoft Access database interface for 'Events'. The main form is titled 'Event' and contains several sections for data entry:

- Event Times:** Includes fields for 'Begin' (07:13:00), 'End' (07:16:41), and 'Initiated' (checked).
- 2nd Party:** A grid of checkboxes for various roles including RN, Triage nurse, NUM, Non ED nurse, Reg, Specialist Reg, GP, Radiographer, Pharmacist, Patient, Patient Relative, RNCo-ord, Nurse specialist, Agency nurse, Medical student, Specialist consultant, Ambulance officer, Clerk, General public, Phone directory, Switch, Porter, Staff unknown, Pathology, Unknown party, and Other party (with a 'Specify other party' text box).
- Interaction Type:** A grid of checkboxes for actions such as Give request, Receive request, Patient Management, Handover, Ward round, Organise investigation, Admin, Social, Give Info, Receive Info, Greet, Ward management, Consult, Education, Get Result, Prescribe meds, Transfer phone call, and Study talk.
- Channel:** A grid of checkboxes for communication methods including Phone, Fax, Computer, Paper medical record, Notice board, Literature, F2F, Pager, Voice mail, e-mail, Paper request form, White board, Text Book, Letter, Paper source, Post-it-note, Admissions Book, Staff Communication book, EDIS, MIMS, and CIAP.

The bottom status bar indicates 'Record: 1 of 135' and 'Form View'.

The data were exported into Microsoft Excel ® and SPSS software ® (version 11.5) for statistical analysis. The data from all subjects were pooled into their respective categories and analyzed to derive seven major quantitative measures:

- (1) The percentage of time spent in communication events, i.e., communication load.
- (2) The proportion of multi-concurrent communication events.
- (3) Synchronous versus asynchronous channel use.
- (4) The proportion of interruptions experienced by subjects relative to communication events.
- (5) The proportion of turn-taking interruptions.
- (6) Purpose of communication events.
- (7) Purpose of interruptions.

Further refinement of each measure is provided in the results section. Ninety-five percent confidence intervals were calculated to allow examination of the differences between clinical groups.

APPENDIX 1

Information statement & consent form, Page1

PROFESSOR ENRICO COIERA
FACULTY OF MEDICINE

PHONE: 9385 3970
FAX: 9385 1813
EMAIL: DRGEORGEALVAREZ@HOTMAIL.COM

SOUTH EASTERN SYDNEY AREA HEALTH SERVICE ST. GEORGE PUBLIC HOSPITAL

PARTICIPANT (HOSPITAL EMPLOYEES) INFORMATION STATEMENT AND CONSENT FORM

Communication behaviours in the clinical setting

You are invited to participate in a study exploring communication behaviours and patterns of information exchange by healthcare professionals in a clinical environment, specifically an Intensive Care Unit of a tertiary referral hospital. We hope to learn what are both the effective and ineffective channels of communication by, and among health professionals, and what events hinder information flow and feedback related to the delivery of quality patient care. You were selected as a possible participant in this study because you are currently employed as a nurse or medical practitioner in the Intensive Care Unit of St. George Public Hospital. To obtain accurate information on communication behaviours and identify events as they occur, a number of staff will be invited to have conversations recorded on audiotapes and observed by a researcher as they conduct their normal daily clinical activities.

If you decide to participate you will be asked to wear a lapel microphone for two to three hours, depending on your role, and the flow of events. During this time a researcher, Dr. George Alvarez, will observe you.

Audio recordings of a brief interview will be made before and after the observation. The researcher will ask the participant to describe their expected duties during the observation period. The pre- and post- observation interviews will take approximately 10 minutes. All recordings will be transcribed for data analysis.

We cannot guarantee that you will receive any direct and immediate benefits from this study. However, it is hoped that the project will contribute to improved patient outcomes by improving communication within the clinical environment.

Within the limits of legal requirements any information that is obtained in connection with this study and can be identified with you will remain confidential. This includes the disclosure of information that may affect your employment status or incur penalty. The data from this study will be stored in locked cabinets/password protected computer files, accessed only by the research team, at the Centre of Health Informatics

The results of this study will be discussed with the staff of the clinical area and published in the healthcare literature. In any publication, information will be provided in such a way that you cannot (or the institution) be identified.

Your decision whether or not to participate will not prejudice your employment with your current employer. If you decide to participate you are free to withdraw your consent and discontinue participation at any time without prejudice.

If you have any questions about the study please ask the researcher. Any additional questions that arise at a later date, Professor Coiera (9385-3970) will be happy to answer them. You will be given a copy of this form to keep.

SOUTH EASTERN SYDNEY AREA HEALTH SERVICE
ST. GEORGE PUBLIC HOSPITAL

PARTICIPANT (HOSPITAL STAFF) INFORMATION STATEMENT AND CONSENT FORM

Communication behaviours in the clinical setting

You are making a decision whether or not to participate. Your signature indicates that you have decided to participate having read the information statement.

Signature of subject

Signature of witness

Please PRINT name

Please PRINT name

Date

Nature of Witness

Signature of investigator

Please PRINT name

REVOCATION OF CONSENT

I hereby wish to WITHDRAW my consent to participate in the research proposal described on the previous page and understand that such a withdrawal WILL NOT make any difference to my medical care or my relationship with the Hospital or my medical attendants.

Signature

Please PRINT name

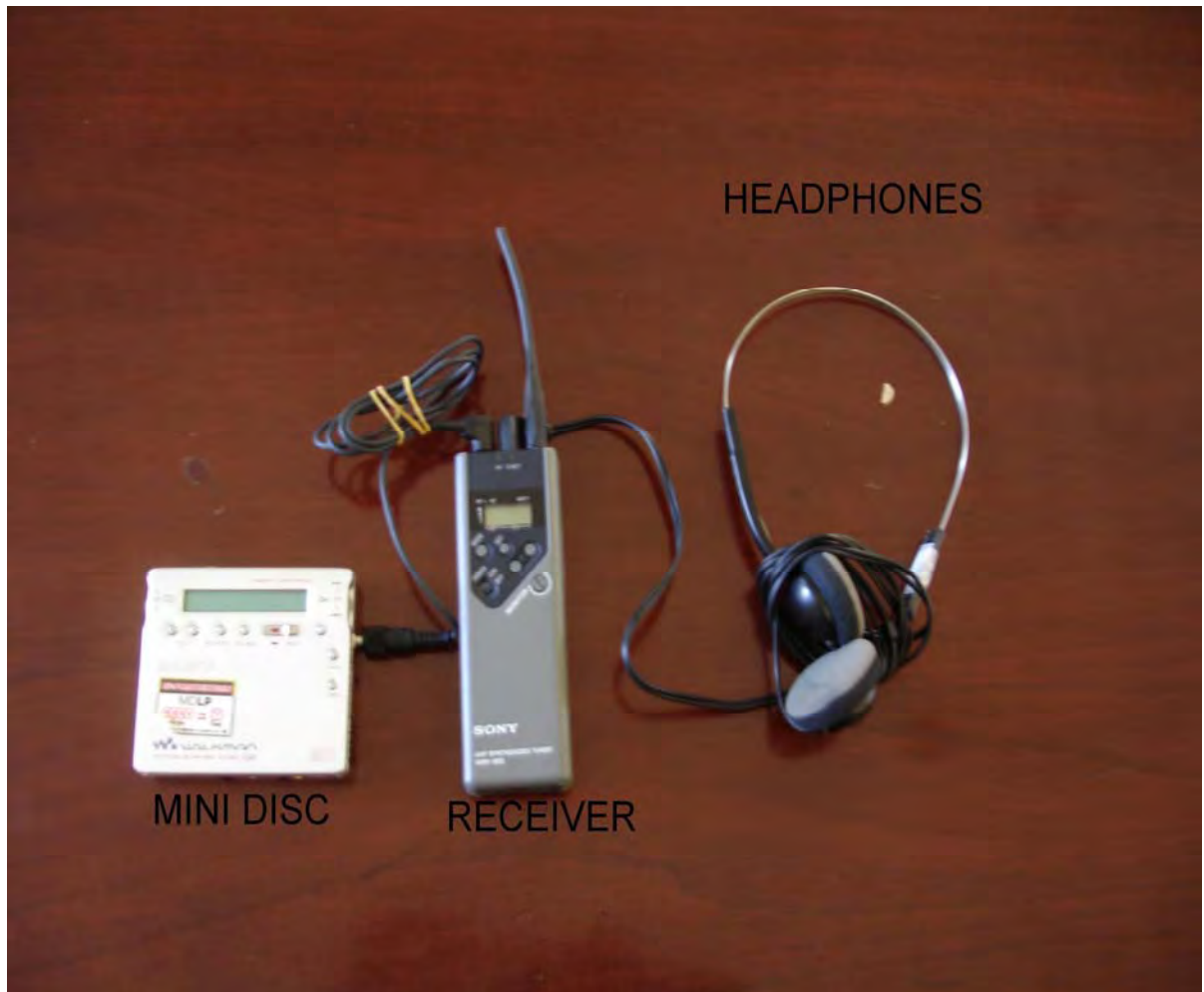
Date

*The section for Revocation of Consent should be forwarded to
Professor Enrico Coiera (Fax: 9385 1813)*

APPENDIX 2

Researcher equipment used for observation:

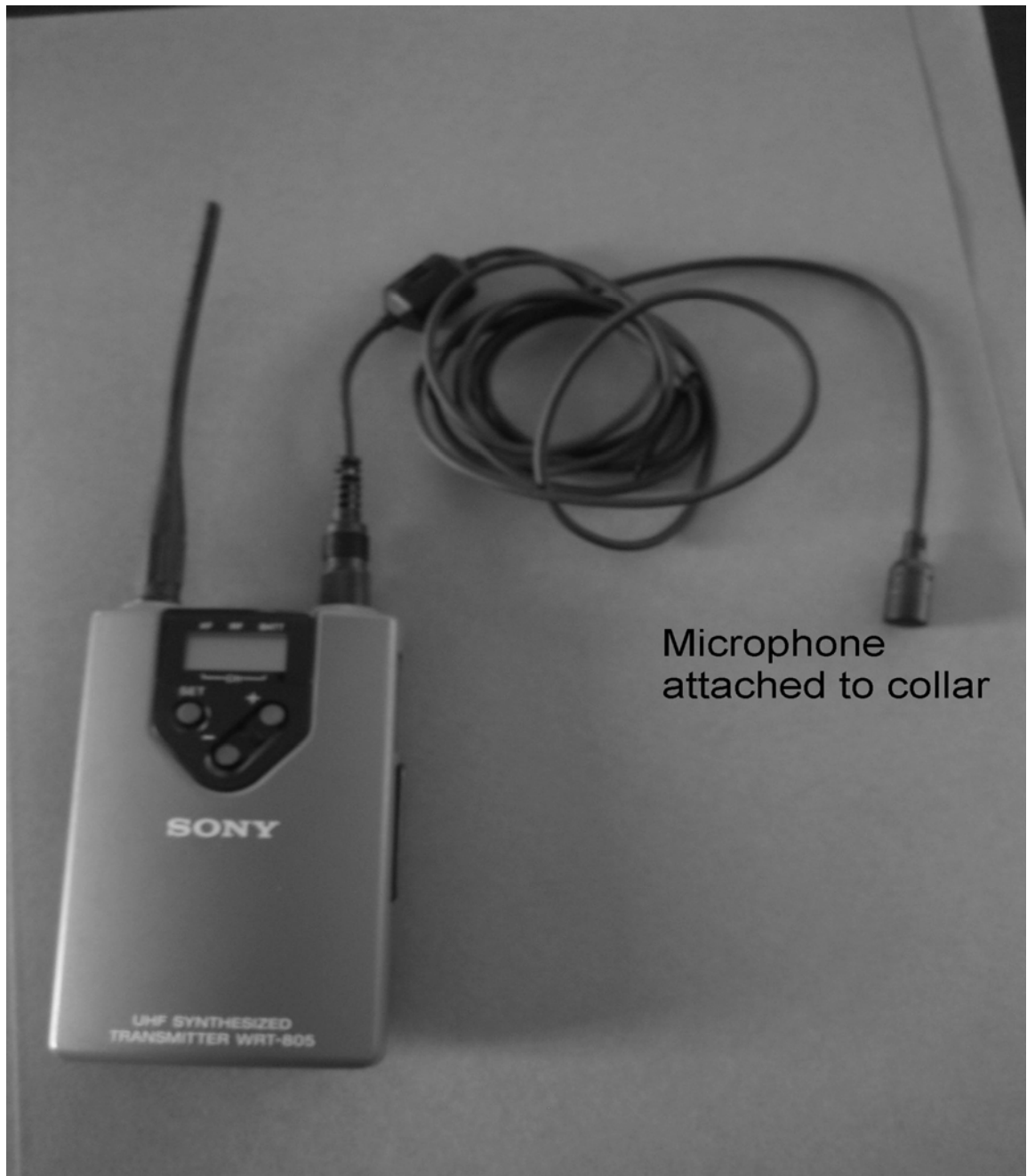
MINI-DISC, MICROPHONE RECEIVER AND HEADPHONES



APPENDIX 3

Subject equipment used for observation:

RADIO-TRANSMITTER & MICROPHONE



CHAPTER 5 - RESULTS

A. Overview

The nine volunteers were observed during the ward round, in the ICU for a total of 24 hours using the Communication Observation Manual. The following results reflect the observation of nine intensive care staff—3 senior registrars, 3 junior registrars; 3 nurses. All nurses were female and all the registrars were male. The communication event time reflects the time an observed volunteer was engaged in a communication event, that is, the passing of information from one party to another across a communication channel (see Figure 4.3). As an entire group, communication event time occurred for 17.5 hours (75%) of the total 24 hours observed.

Table 5.1: Summary of study results.

	Nurses	Junior registrars	Senior registrars	Total
Observation time	8:40:10	6:03:10	9:16:08	23:59:28
Communication event time	5:23:24	5:03:19	7:04:26	17:31:09
% Time in Comm. events	62.3%	85.1%	77.1%	75%
Number of events	417	341	697	1425
Communication events	381	186	366	933
Turn-taking interruptions	36	155	301	492

During the observation time, 1425 distinct events involving observed subjects were recorded, of which 933 [65.5%; 95%CI 63.0-68.0] were communication events and 492 [34.5%; 95%CI 32.0-40.0] were turn-taking interruptions. Communication events and turn-taking interruptions were then classified as initiated or received (from the perspective of the observed individual).

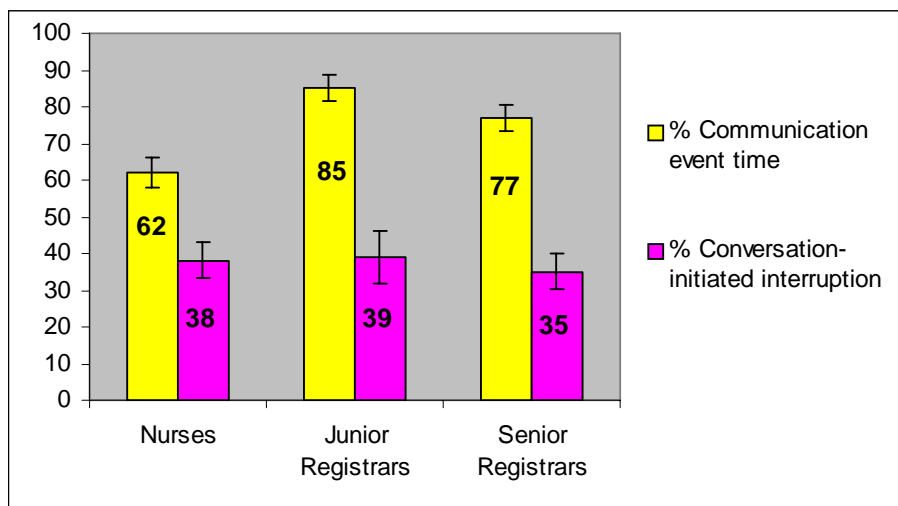
Table 5.2: Communication events and turn-taking interruptions by clinical role
(**C.I.I. = conversation initiated interruption).

	Nurses	Junior Registrar	Senior registrar	Total
Total number events (A plus B)	417	341	667	1425
A. Communication events	381	186	366	933
Initiated	236	114	238	588
Received (C.I.I.)* *	145	72	128	345
B. Turn-taking interruptions	36	155	301	492
Initiated	24	99	149	272
Received	12	57	152	221

B. Communication Patterns:

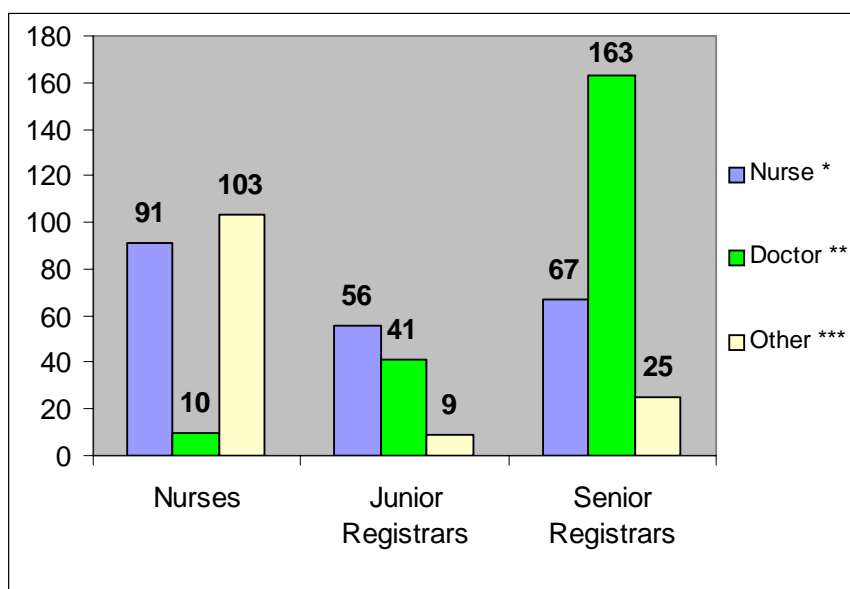
Participants spent an average of 75% [95%CI 72.8-77.2] of their observation time in communication events. Time in communication varied by role (figure 5.1). Nurses spent 62% [95%CI 58.1-66.5] of their time in communication, junior registrars 85% [95%CI 81.4-88.8] and senior registrars 77% [95%CI 73.6-80.6]. Over a third (37%; 95%CI 33.8-40.0] of the communication events were classified as conversation-initiated interruptions (C.I.I.), meaning that the conversations were not initiated by the observed subject, and occurred using a synchronous communication channel.

Figure 5.1: Percentage of time clinical groups spent in communication and conversation-initiated interruptions (C.I.I.).



Of the total 933 communication events, there were 588 initiated conversations by the observed subjects. Figure 5.2 displays which clinical group initiated conversations with whom during the ward round. The total number is less than 588 because it was possible for the observed subject to initiate a conversation with more than one person at a time. It is apparent that the observed subject(s) interacted with a variety of other ICU roles, providing a sample of a broader set of individuals other than nurses, junior and senior registrars.

Figure 5.2: Number of initiated conversations by each clinical group.



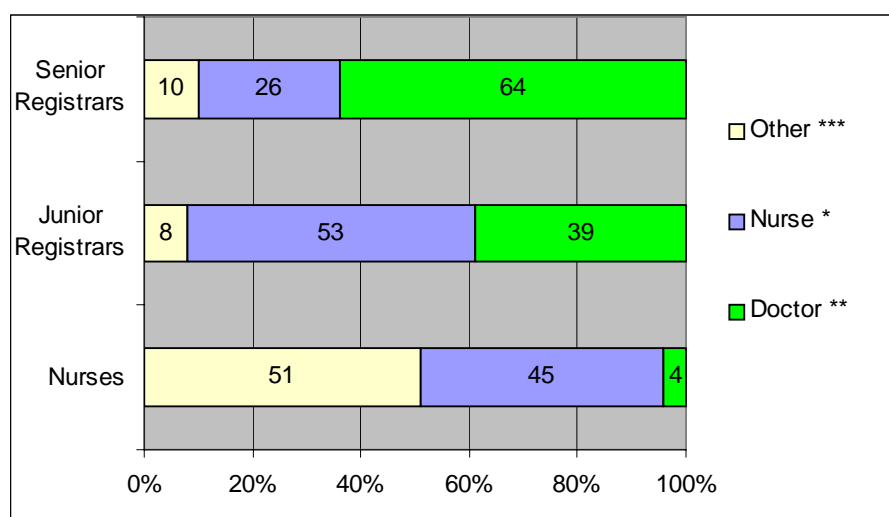
* Includes bedside nurses, charge nurse and nurse unit manager.

** Includes consultants, junior/senior registrars and residents.

***Includes patients' families, students, social workers, physiotherapist, ward-clerks, pharmacists, porters and X-ray staff.

Figure 5.3 displays, by proportion, which observed group initiated conversations with whom in the ICU. Nurses spoke to the “other” group considerably more than to senior or junior registrars, 51% [95%CI 44.1-57.9] compared to 10% [95%CI 6.3-13.7] and 8% [95%CI 2.8-13.2], respectively. The nurses [53%; 95%CI 43.5-63.5], and junior registrars, [45%; 95%CI 31.2-51.8], had more conversations with the “nurse” group than did the senior registrars, [26%; 95%CI 20.6-31.4]. There was no difference between the initiated conversations of junior registrars and nurses with the “nurse” group. Senior registrars initiated conversations with other doctors more often [64%; 95%CI 58.1-69.9] than did the junior registrars [39%; 95%CI 29.7-48.3] or the nurses [39%; 95%CI 29.7-48.3]

Figure 5.3: Proportions of initiated conversations in each clinical group.



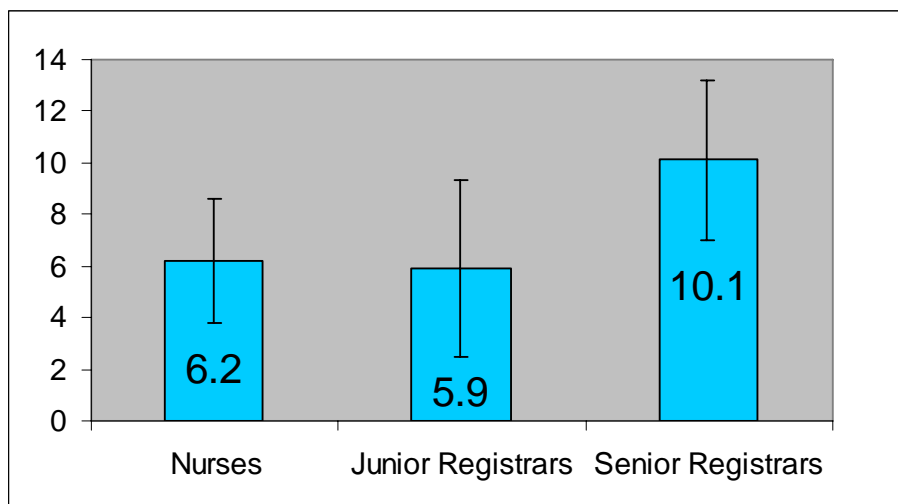
* Includes bedside nurses, charge nurse and nurse unit manager.

** Includes consultants, junior/senior registrars and residents.

***Includes patients' families, students, social workers, physiotherapist, ward-clerks, pharmacists, porters and X-ray staff.

Multiple-communication events occurred when a subject experienced two or more overlapping communication events at one time. The group as a whole spent 7.3% [95%CI 5.6- 9.0] of their communication time in multiple communication events (Figure 5.4). Nurses spent 6.2% [95%CI 3.8-8.6] of their time in multiple communication events, junior registrars 5.9% [95%CI 2.5-9.3] and senior registrars 10.1% [95%CI 7.0-13.2].

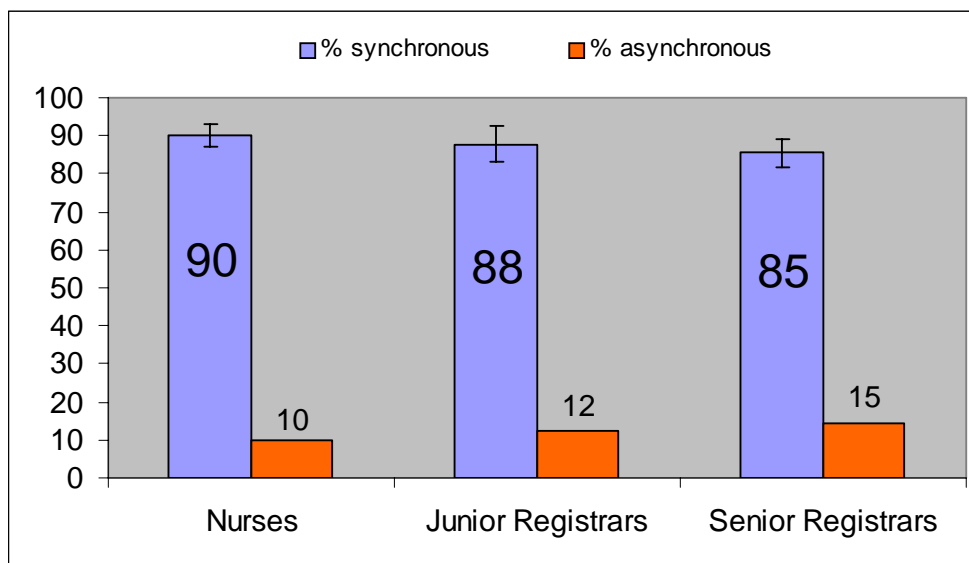
Figure 5.4: Percentage of time each clinical group spent in overlapping communication events.



C. Communication channels:

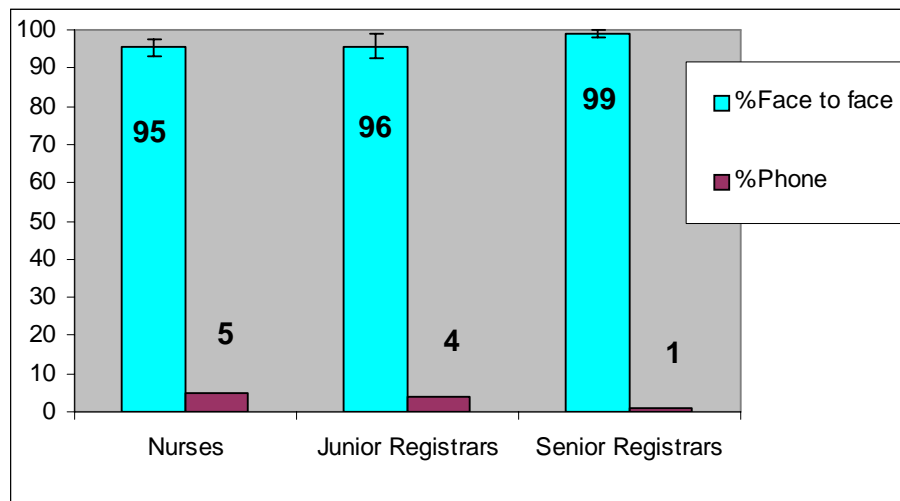
Eighty-eight percent [95%CI 85.9-90.0] of all communication events involved the use of a synchronous channel (Figure 5.5). Nurses used a synchronous channel 90% [95%CI 87.0-93.0] of the time, junior registrars 88% [95%CI 83.3-92.7] and senior registrars 85% [95%CI 81.3-88.7].

Figure 5.5: Percentage of communication events which used synchronous or asynchronous communication channels.



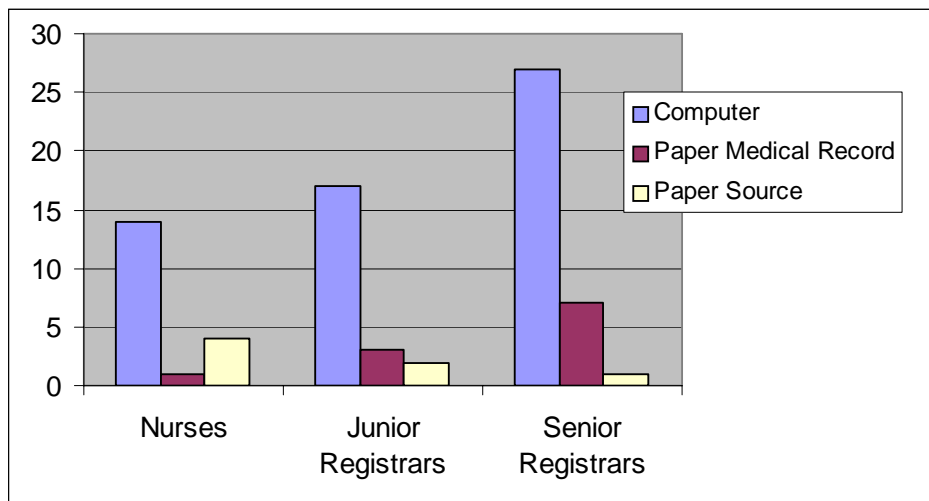
There were only two synchronous channels used in this cohort, face-to-face and the telephone. Face-to-face was responsible for 97% [95%CI 95.8-98.2] of all the synchronous communication events (Figure 5.6). Nurses used a face-to-face synchronous channel 95% [95%CI 93.2-97.6] of the time, junior registrars 96% [95%CI 92.6-98.8] and senior registrars 99% [95%CI 98.0-100.0].

Figure 5.6: Percentage use of synchronous communication channels.



Of the total 933 communication events, there were only 76 events using the three asynchronous channels as shown in Figure 5.7. This particular ICU has a computer at each bedside and has endeavoured to move towards paperless documentation. The paper medical record was used to acquire past medical history of patients and all paper source interactions were requests for laboratory or radiology.

Figure 5.7: Use of asynchronous communication channels.



D. Interruptions

Looking at the total 933 communication events, Figure 5.8 arranges the events as initiated (n=588) versus conversation-initiated interruptions, C.I.I. (n=345). Over a third (37%; 95%CI 33.9-40.1] of the communication events were classified as C.I.I., meaning that they were received by the observed subject, and occurred using a synchronous communication channel. Conversation-initiated interruptions represented 38 % [95%CI 33.2-43.0] of nurses' communication events; 39% [95%CI 31.7-45.7] of junior registrars' and 35% [95%CI 30.1-39.9] senior registrars' communication events.

Figure 5.8: Total communication events categorized as initiated versus conversation-initiated interruptions (C.I.I.).

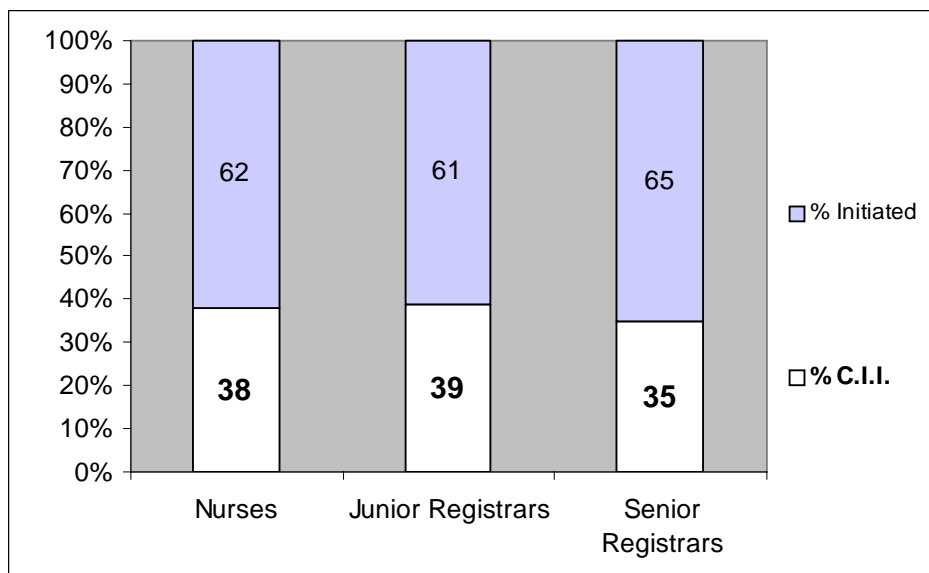


Figure 5.9 complements Figure 5.8 by showing the amount of time in either initiated communication events or conversation-initiated interruptions (C.I.I.). The group spent approximately 5 hours and 53 minutes (34%) of the 17.5 hours of communication event time (see also Table 5.1) involved in interruptive communication.

Figure 5.9: Communication time as either initiated or interrupted.

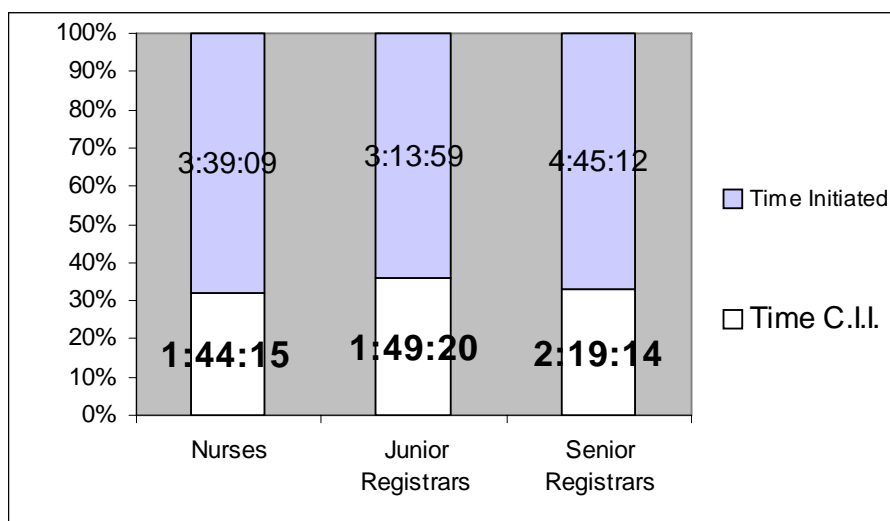
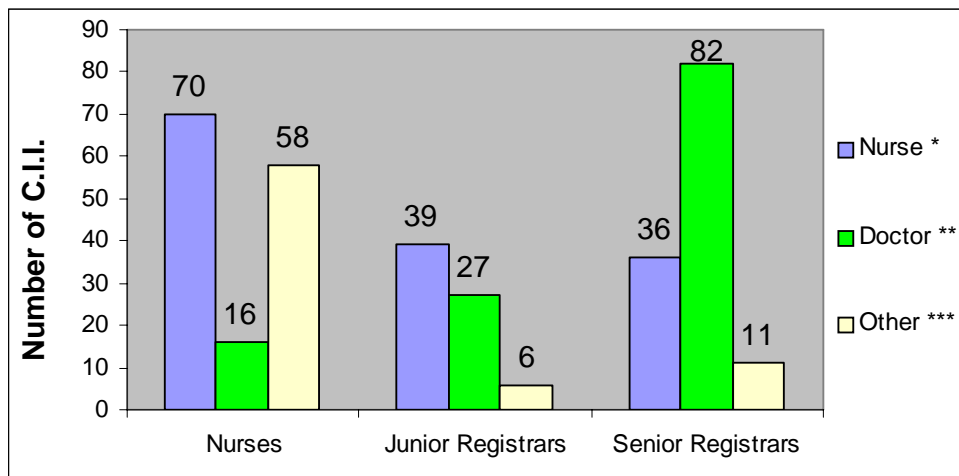


Figure 5.10 illustrates which groups were responsible for the conversation-initiating interruptions experienced by the observed volunteers. There were a total of 345-recorded conversation-initiating interruptions (C.I.I.). Figure 5.10 provides the raw numbers of C.I.I. received whereas Figure 5.11 shows C.I.I. source as a proportion of the total number of C.I.I. received in that clinical group.

Figure 5.10: Number of conversation-initiating interruptions received by observed volunteers.



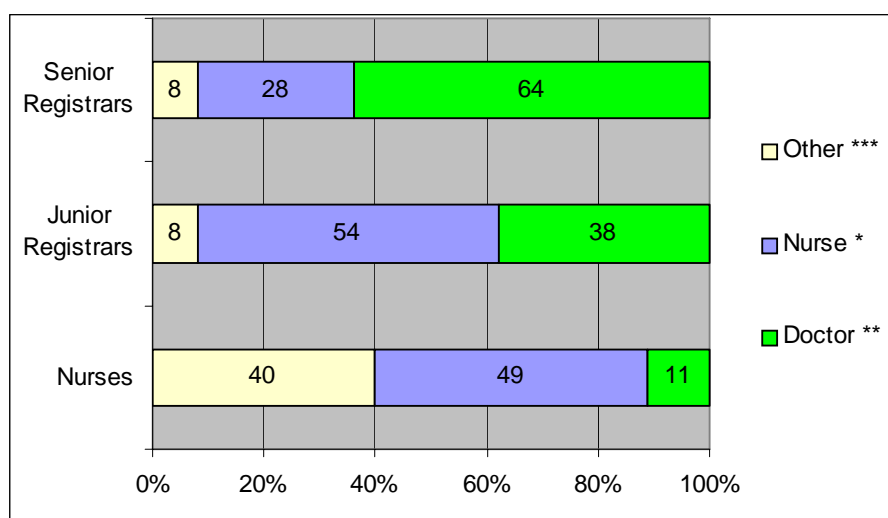
* Includes bedside nurses, charge nurse and nurse unit manager.

** Includes consultants, junior/senior registrars and residents.

***Includes patients' families, students, social workers, physiotherapist, ward-clerks, pharmacists, porters and X-ray staff.

The “other” group interrupted nurses appreciably more than they interrupted either the senior or junior registrars, 40% [95%CI 32.0-48.0] compared to 8% [95%CI 3.3-12.7] and 8% [95%CI 1.7-14.3], respectively. There appeared to be no difference between the C.I.I. from the “nurse” group towards junior registrars or nurses, 54% [95%CI 42.5-65.5] vs. 49% [95%CI 40.8-57.2]. Senior registrars, on the other hand, experienced 28% [95%CI 20.3-35.7] C.I.I. from the “nurse” group. There were also a notable difference between the C.I.I. from the “doctor” group experienced by senior registrars—64% [95%CI 55.7-72.3], junior registrars—38% [95%CI 26.8-49.2] and nurses—11% [95%CI 5.9-16.1].

Figure 5.11: Proportions of conversation-initiating interruptions (C.I.I.) in each clinical group.



It is interesting to compare the remarkable similarities between figures 5.11 and 5.3. These two graphs suggest that clinical groups tend not only to speak to similar groups, but also interrupt within similar groups.

Figure 5.12 presents the average number of conversation-initiated interruption (C.I.I.) per hour for each clinical group. As an entire group, the nine subjects averaged 14.4 C.I.I. per hour. Figure 5.13 complements Figure 5.12 by demonstrating the average duration of each C.I.I.

Figure 5.12: Conversation-initiated interruptions per hour and clinical role.

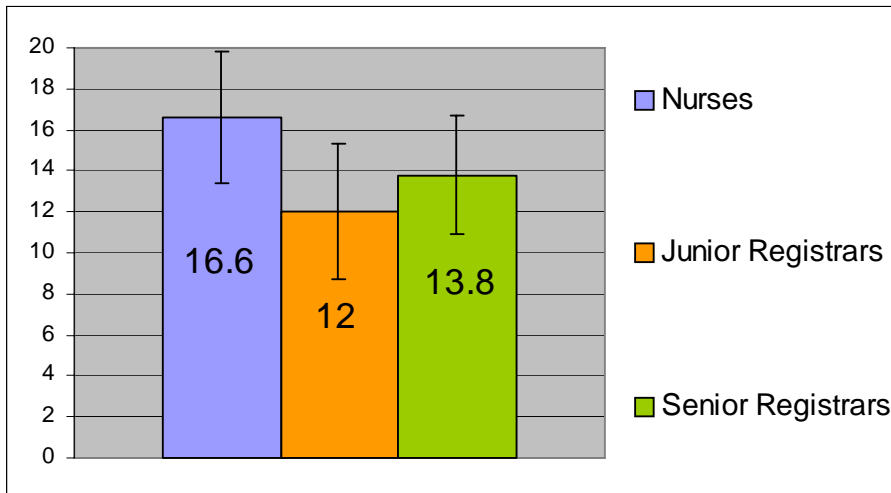
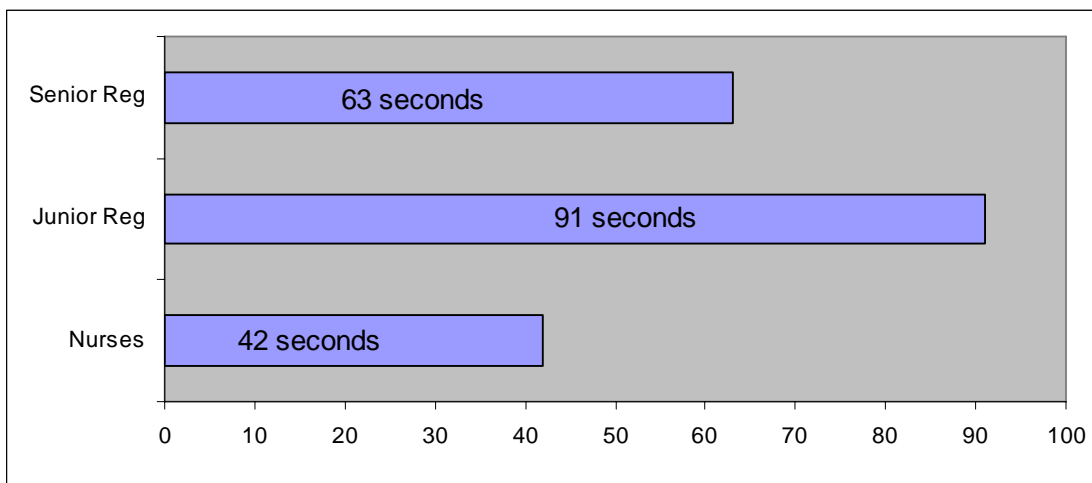


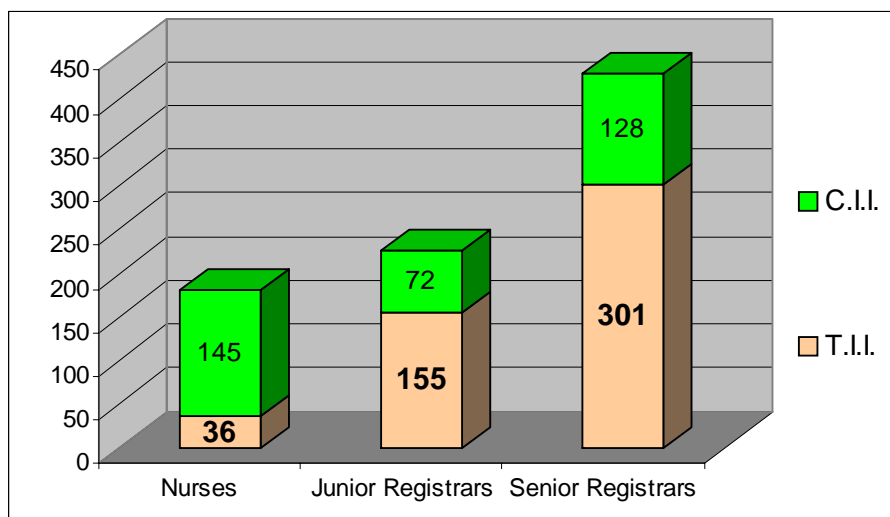
Figure 5.13: Average duration of conversation-initiated interruption.



E. Turn-Taking Interruptions

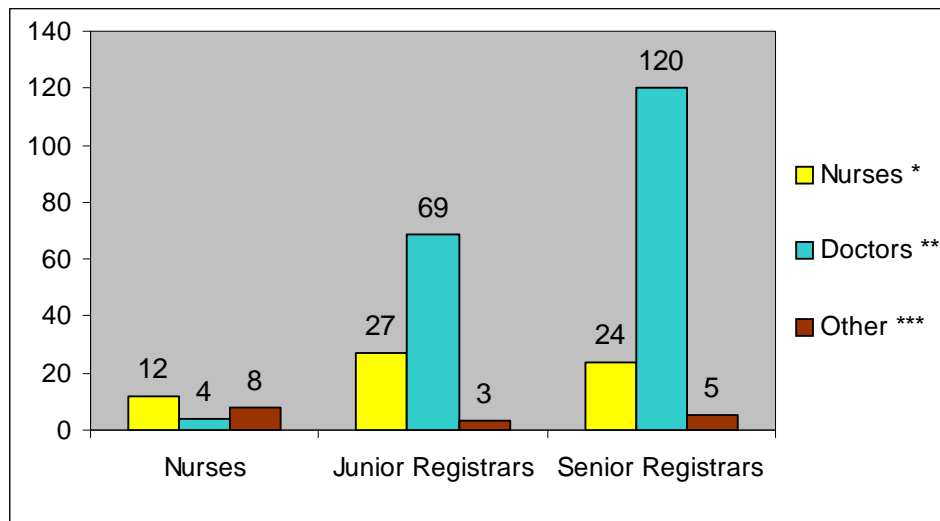
Turn-taking interruptions (T.I.I.) made up 35% [95%CI 32.0-37.0] of all events observed, (n=492). T.T.I. accounted for 5.3% (56 minutes) of total communication event time. T.T.I. and conversation-initiated interruptions (C.I.I.) were not evenly distributed across clinical roles (Figure 5.14). Junior and senior registrars had roughly twice the number of T.T.I. as compared to C.I.I. The junior registrars had 155 [45%; 95%CI 40.2-50.8] T.T.I. versus 72 [21%; 95%CI 16.7-25.3] C.I.I. The senior registrars had 301 [45% 95%CI 41.3-48.9] T.T.I. compared to 128 [19%; 95%CI 16.0-22.0] C.I.I. This is in sharp contrast to the nurses where C.I.I. were four times as many compared to T.T.I., 145 [35%; 95%CI 30.4-39.6] versus 36 [9%; 95%CI 5.9-11.3] respectively. The average time for a TT interruption was 6 seconds for all three clinical groups.

Figure 5.14: Number of turn-taking interruptions (T.T.I.) versus conversation-initiated interruptions (C.I.I.).



Figures 5.15 & 5.16 clearly show that the doctors in this ICU were responsible for the majority of turn-taking interruptions (T.T.I.). Of all *initiated* T.T.I. by the observed subjects, 71% [n=192, 95%CI 65.3-76.0] were by physicians. Similarly, doctors committed 72% [n=160; 95%CI 66.5-78.3] of all *received* turn-taking interruptions. The senior registrar is expected to coordinate most of the patient care. It is therefore not surprising that the senior registrar's T.T.I. represented 61% (n=301; 95%CI 56.9-65.5] of all turn-taking interruptions.

Figure 5.15: Number of turn-taking interruptions *initiated* by observed clinicians towards a second party.

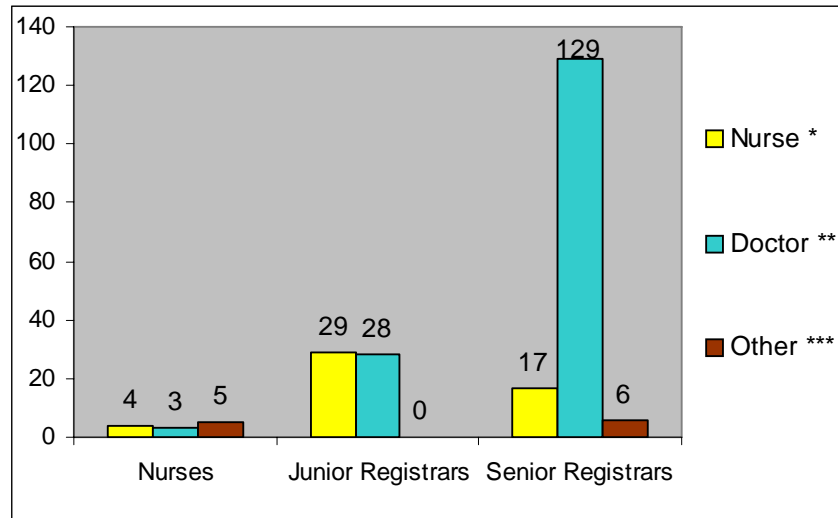


* Includes bedside nurses, charge nurse and nurse unit manager.

** Includes consultants, junior/senior registrars and residents.

***Includes patients' families, students, social workers, physiotherapist, ward-clerks, pharmacists, porters and X-ray staff.

Figure 5.16: Number of turn-taking interruptions *received* by observed clinicians from a second party.



* Includes bedside nurses, charge nurse and nurse unit manager.

** Includes consultants, junior/senior registrars and residents.

***Includes patients' families, students, social workers, physiotherapist, ward-clerks, pharmacists, porters and X-ray staff.

F. Purpose of Communication & Interruption

Communication events and communication-initiating interruption (C.I.I.) events could be coded with more than one major topic. Although the majority of conversations and C.I.I. predictably focused around patient care, some differences are apparent between subjects (Figures 5.17-5.22). These differences reflect clinicians' respective roles in patient care. It should be noted, however, that all clinical groups were engaged in all tasks, but their relative proportion are different.

When one compares the purpose of communication events versus the purpose of C.I.I. for each clinical group, the graphs appear similar. This suggests that clinical groups tend to be interrupted for similar reasons to their own communication purposes.

Figure 5.17: Purpose of communication events for nurses.

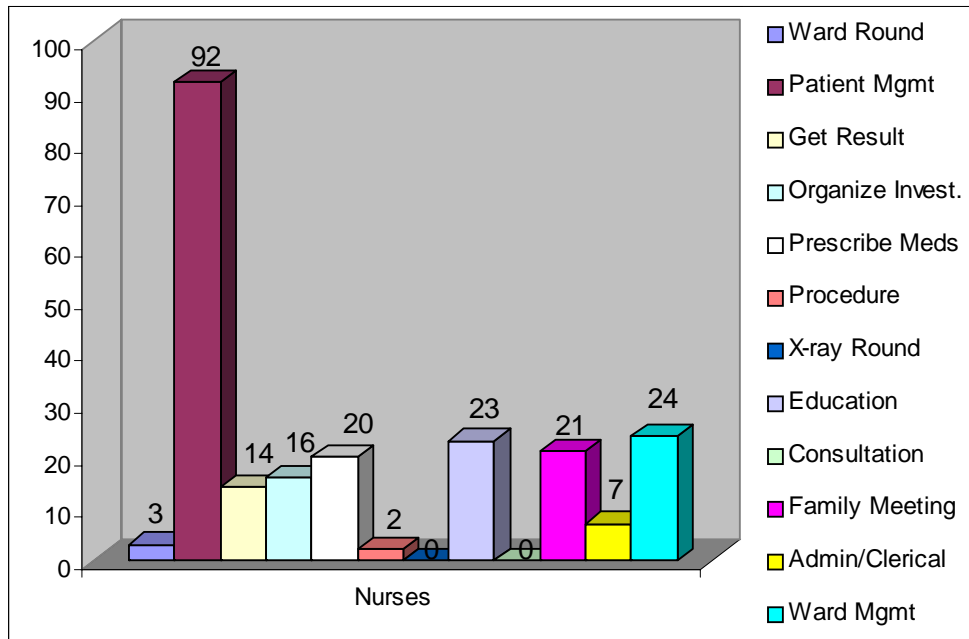


Figure 5.18: Purpose of C.I.I. for nurses.

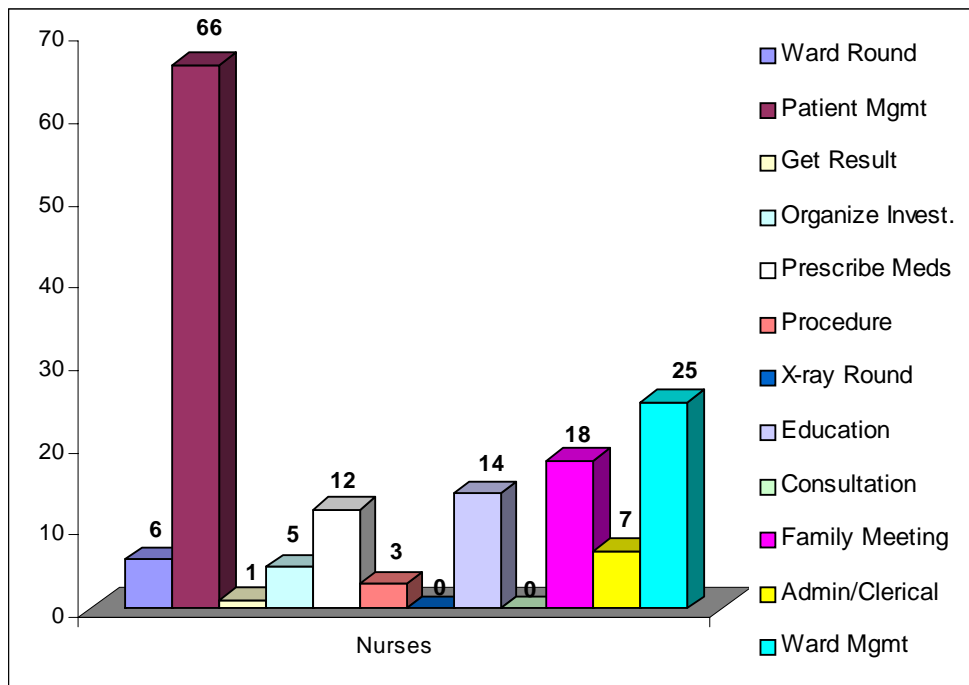


Figure 5.19: Purpose of communication events for junior registrars.

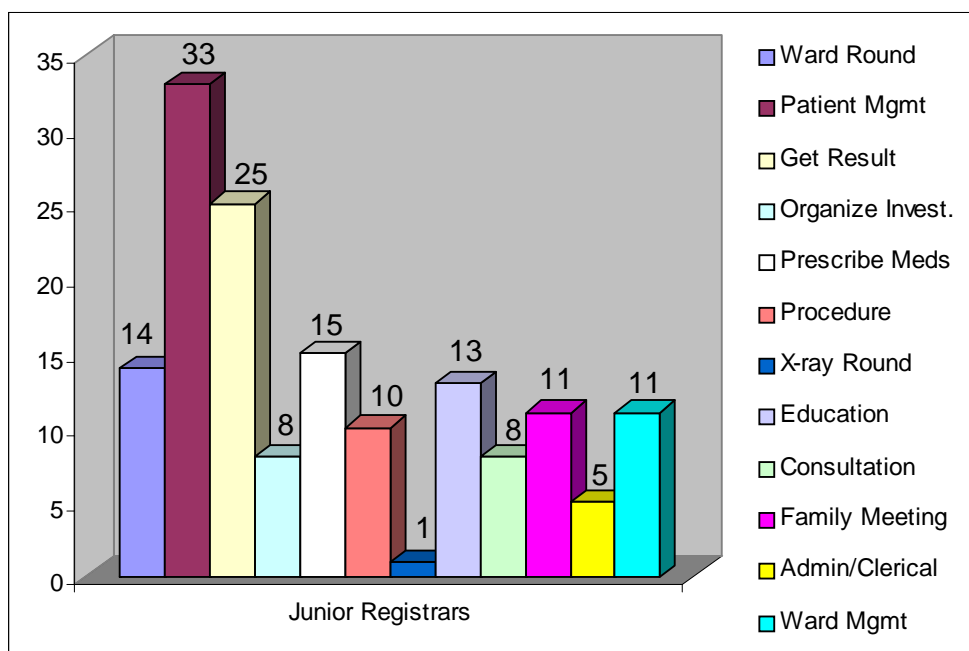


Figure 5.20: Purpose of C.I.I for junior registrars.

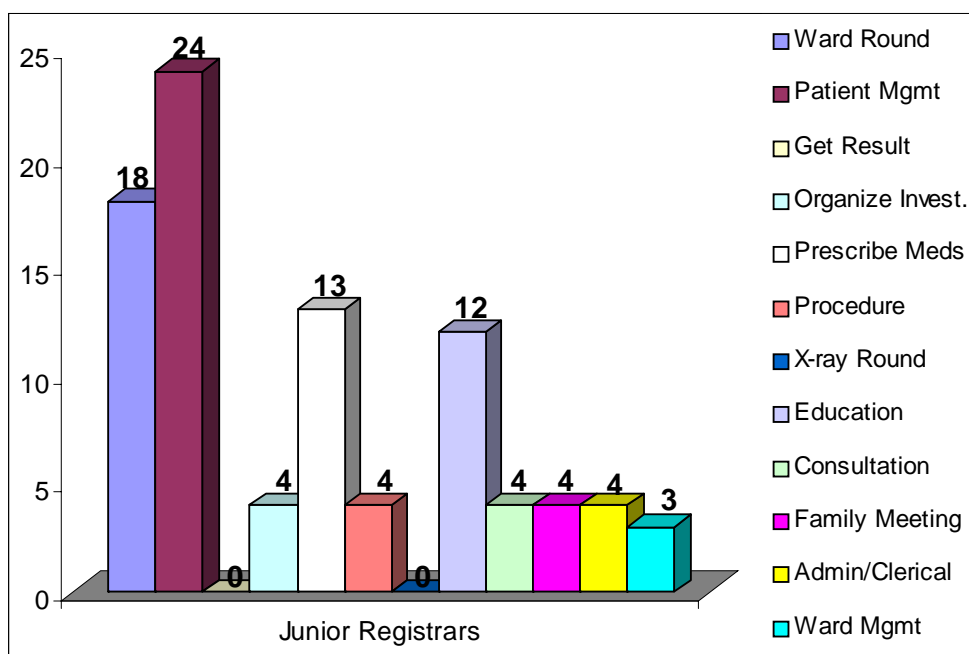


Figure 5.21: Purpose of communication events for senior registrars.

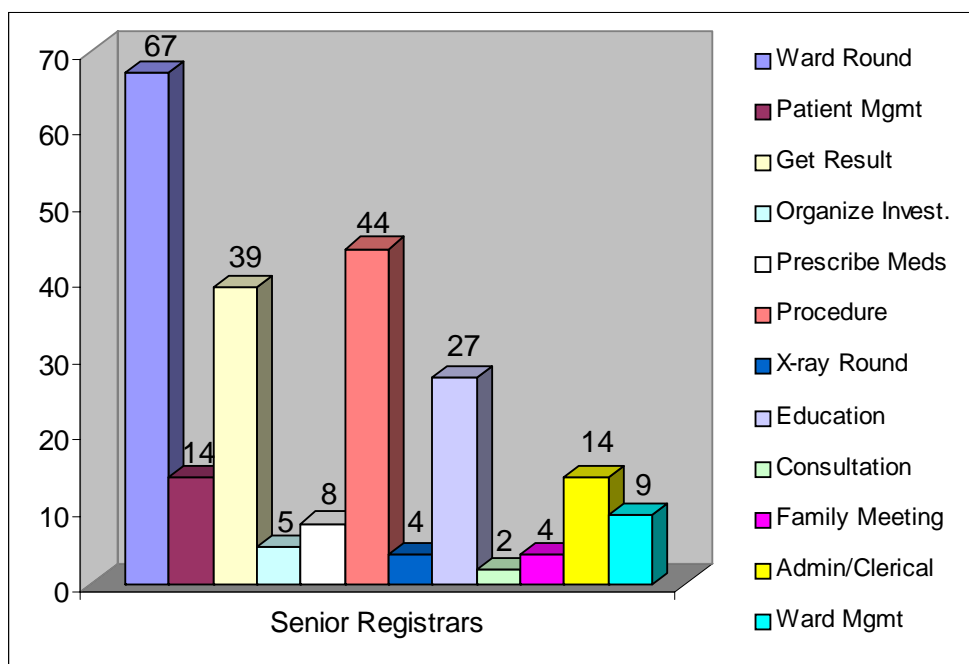


Figure 5.22: Purpose of C.I.I. for senior registrars.

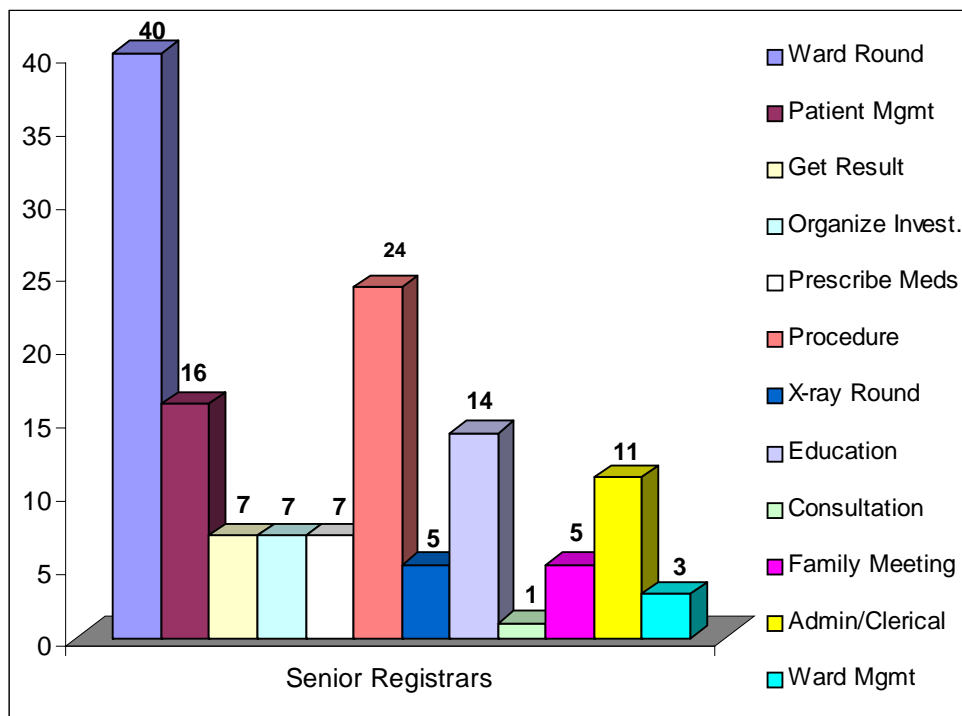
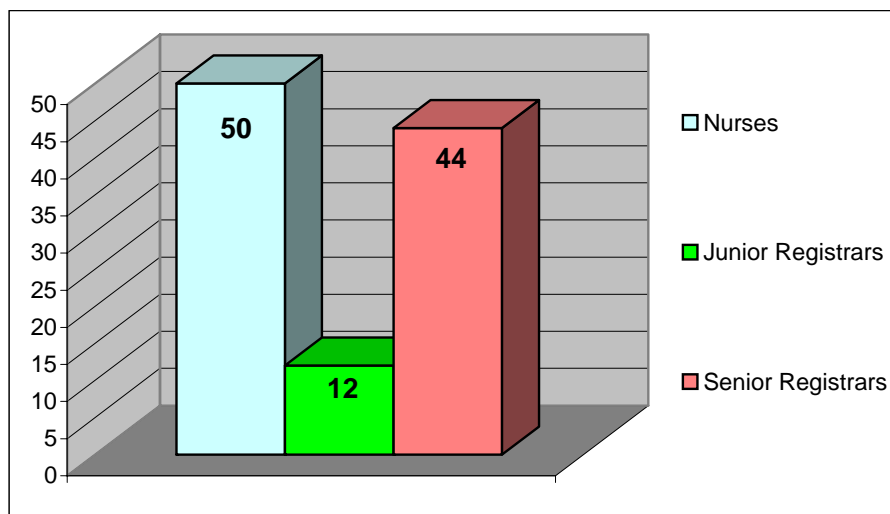


Figure 5.23 presents the total number of conversations that were of pure social context with no relation to patient care or other normal ICU duties. Senior registrars had 44 social conversations consuming ≈ 34 minutes (8%) of their total communication time. Nurses spent ≈ 16 minutes (5%) of their communication time in 50 social interactions compared with junior registrars spending just over 6 minutes (2%) in their 12 purely social conversations.

Figure 5.23: Number of social conversations.



CHAPTER 6 - DISCUSSION

The results of the study are subject to limitations and sources of potential error. Firstly, observations were conducted in a single intensive care unit (ICU). It cannot be assumed that the communication patterns observed can be generalized to other parts of the hospital, other ICUs in New South Wales, different hospitals within Australia or even other countries. However, literature from both ICU and non-ICU settings suggest similar patterns (54;139-142), as discussed in chapter three.

All observations centred on the ward-round because most of the decision-making and therefore many of the conversations in the ICU occurred during this time. Communication patterns are likely to be different during other parts of the day and obviously would differ in non-hospital and non-ICU settings. Thirdly, one observer conducted all observations and it is possible that another person would have coded the conversations differently, i.e., there is no inter-observer reliability. The methodology is essentially an ethnographic study, which involves researcher immersion into a “culture” to observe and analyse behaviour of individuals with reference to shared norms, beliefs, assumptions, and principles of action and organization (143). The observer is a trained intensive care physician in both Canada and Australia. Therefore, the observer would have more experience and a different appreciation of the working environment than a non-medical or non-ICU researcher. However, the researcher’s familiarity with the ICU may have “blinded” him to some of the features of the ICU that could be viewed as important by another researcher.

The methodology was largely based on the Communication Observation Manual as created by the Centre of Health Informatics at the University of New South Wales, Sydney (136).

Although it has been refined (144) and successfully used and validated (138), it has never been compared to a 'gold standard'. Unfortunately, to the author's knowledge, this is the first attempt to construct a detailed method to observe communication and thus cannot avoid these hazards. Finally, it is possible that the behaviour of the volunteers may have been altered by the subject's awareness of his/her participation, the so-called 'Hawthorne effect' (145). To minimize the 'Hawthorne effect', the investigator stood as far away as possible from the observed subject while maintaining visual contact. The recording device/microphone allowed the investigator to stand anywhere in the ICU without losing the auditory signal. However, it became apparent to the researcher that the volunteers appeared to forget they were being observed. This was reinforced during the debriefing discussion after the observation periods. All volunteers commented that they quickly forgot they were being followed because of their busy clinical duties.

Notwithstanding these weaknesses, the major findings of this study was that intensive care staff of this hospital spent the majority of their ward round time in communication events and that a high percentage of their communication was interruptive. Furthermore, a phenomenon not previously studied was the high rate of turn-taking interruptions that peppered the ICU ward round conversation.

A. Communication Patterns

In this study, participants spent an average of 75% [95% CI 72.8-77.2] of their observation time in communication events (Table 5.1). Taking the three groups separately, ICU nurses spent the least time in communication events during the ward round (Figure 5.1). This is likely because nurses tend to be responsible for only one patient whereas doctors manage the entire ICU patient load, coordinating with different services and specialities. The junior registrars are generally considered the busiest person in the ICU because they perform the majority of tasks whereas senior registrars are more involved in decision-making. Because senior registrars are nearing the completion of their formal training, they are expected to function at a higher level; making final patient management decisions and be in direct liaison with the consultants. Making a decision may involve speaking to the ICU team as a whole but coordinating that decision (for example, arranging a CT scan, the responsibility of the junior registrar) involves several conversations. It is therefore not surprising that the junior registrars were involved in the most communication time. In fact, the one junior registrar with the least communication time, 75%, was greater than the nurse with the most communication time, 73% (data not shown).

Interesting differences between the groups are demonstrated in figure 5.2. Out of the 210 initiated conversations by nurses, only 10 were to doctors. The remaining conversations were evenly split between the nurses and 'other' group. The 'other' group contains patient's family and paramedical staff like pharmacist, porters and social workers. The junior and senior registrars rarely spoke to the 'other' group, only 36 times out of combined 361 initiated conversations. Of the total 214 conversations towards all doctors, senior registrars were responsible for 163, again reflecting the predominant role of patient management in

senior registrar duties. This observation may, in part, be explained by Everett Roger's concept of '*homophily*' in communication networks (146). This fundamental principle of human communication states that the exchange of ideas occur more frequently between individuals who share common attributes, for example, beliefs, education or social status. However, it is also important to note that each group interacted significantly with the nursing staff, highlighting their central role in patient care.

Communication multi-tasking (multi-conversations) occurred when a subject experienced two or more overlapping communication events at one time. The group as a whole spent 7.3% [95%CI 5.6- 9.0] of their communication time in multi-conversations (figure 5.4). Furthermore, 88% [95%CI 85.9-90.0] of all communication events involved the use of a synchronous channel (figure 5.5). These results are comparable to an Australian study of emergency room staff using similar methodology (137). That study's research demonstrated that doctors and nurses averaged 80% of their time in communication events, 10% of communication time involved two or more concurrent conversations and that 90% of observed volunteers used a synchronous channel of communication.

There were only two synchronous channels used in this cohort, face-to-face and the phone. Face-to-face was responsible for 97% [95%CI 95.8-98.2] of the synchronous communication events (figure 5.6), which is similar to 82% face-to-face statistic in the Australian study (137). The high dependence of synchronous or face-to-face interactions among hospital staff has been demonstrated elsewhere. Moss *et al.* followed around operating room charge nurses and found that 67% of their discussions were face-to-face (141). The study was later repeated on a larger scale and found similar results (147). Covell has reported that about 50% of outpatient physician information interactions were face-to-face (148). More interesting,

another study showed that despite having a mature computer-based system, hospital staff continued to prefer face-to-face interactions (142).

Why did the volunteers in this study prefer face-to-face communication? In the intensive care unit (ICU), patients are critically ill and decisions are made that can potentially save lives. Even with non-life threatening situations, ICU patients are considered the sickest patients in the hospital and demand a great deal of time and effort into their management. Doctors and nurses have their patient's best interests at heart; they want management issues dealt with quickly and the quickest way is to speak directly to another person. Furthermore, clinical problems are rarely straightforward especially when dealing with patients in the intensive care unit. These patients have multi-system disease supported by complex technology on a background of clinical instability. Thus, healthcare staff likely seeks out face-to-face interaction and "use" each other's experience and skill in helping to manage their patients. Perhaps it should not be surprising that clinicians favor this immediate acknowledgement style of communication. On the surface, face-to-face communication appears to be beneficial to healthcare staff taking care of their patients. However, this point of view is myopic. Coiera and Tombs were the first authors to discuss the reliance of healthcare staff in utilizing synchronous communication (140). When asked, the subjects rarely considered the consequence of their face-to-face interaction with other colleagues. Subjects in this study wanted tasks "ticked off the list", a way to unburden their working memory by mentally "checking off" tasks concerning their patients. Unfortunately, this can burden other people's working memory especially if these conversations are interruptive in nature. So, although face-to-face conversations may help a clinician's personal efficiency in taking care of their patients, they can generate interruptions that may be overall harmful. This is analogous to everyone deciding to take his or her car to work rather than using public

transport. Easier from a personal level, however, overall traffic congestion worsens which translates into longer route times for everyone (149).

B. Interruptions

Another relevant finding in the current study is the high prevalence of interruptive communication. Over a third (37%; 95%CI 33.9-40.1] of the communication events were classified as conversation-initiated interruptions, meaning that they were received by the observed subject, and occurred using a synchronous communication channel (Figure 5.8). This closely mirrors the Australian study, which showed that 30% of the communication events were interruptions (137). Figure 5.11 demonstrates who were responsible for the conversation-initiated interruptions (C.I.I.) in the present study. It appears that nurses interrupt nurses and doctors interrupt doctors. The majority of nurse C.I.I. were from other nurses. Senior registrars experienced 82 of their 129 C.I.I. from other doctors. Junior registrars were, however, interrupted more often by nurses than doctors. This observation may be explained by comparing the remarkably similar proportions in figures 5.11 and 5.3. It may be that one is simply interrupted more often by the people with whom one interacts most often? It would help explain why the 'other' group contributes so heavily to the nurse's C.I.I. but minimally to the junior and senior registrars.

Further analysis of the Australian data was done to determine whether there were differences in role-related communication patterns (138). Senior medical and nursing staff experienced higher rates of interruption than junior medical staff, averaging 15 interruptions per hour. This is concordant with the present study, which revealed 14 interruptions per hour, and that, senior registrars and nurses experienced higher rates of interruption than junior registrars (Figures 5.12 & 5.13). Studies by Chisholm *et al.* reported 10 interruptions per hour in an American emergency department (139), this compared to 4 interruptions per hour in an outpatient primary care setting (150). The number of interruptions ($r = 0.63$; $p < 0.001$) was

positively correlated with the average number of patients simultaneously managed (139). This is alarming because it implies that the busier the clinician was, the more likely he/she was to get interrupted—the opposite of what one would like to occur!

Authors like Rasmussen have asked the medical community to analyse non-traditional sources of latent error, namely, interruption from co-workers, conflicting and excessive task demands (151). Work overload has long been shown to negatively effect employee productivity and incite feelings of tension, anger and personal failure (152;153). Pager interruptions contribute to sleep deprivation in medical residents and increase feeling of stress and work inefficiency (154). Pharmacist cite interruptions as one of the most important contributing factors to drug dispensing errors (155;156). Interruptions at work and home were shown to be predictive of high levels of job dissatisfaction and mental well being for British physicians (157). The authors of Britain study suggest that the number of workplace interruptions may be an important ergonomic factor contributing to inefficiency, stress and increased error. Moreover, an Australian study showed that emergency physicians were reducing their working hours in response to work overload and stress, a finding with important implications for professional longevity and work force planning (158).

The aviation industry has also recognized the consequences of interruption as evidenced by a study examining the typical operations involved in the preflight phase of flight (159). That paper found that interruptions dramatically increase the opportunities for errors because distractions threaten to sidetrack even the most meticulous and experienced pilot. Dismukes and coworkers suggest treating interruptions as “red flags” and advocate methods to reduce the danger of interruptions towards pilots (160). An analysis of the Tenerife air disaster proposes that miscommunication coupled with interruptions of important routines were

among some of the leading root causes of this tragedy (161). Cook and Woods summarize the plausible repercussion of interruptions in the medical domain: “the physician whose attention is constantly shifting from one item to another may not be able to formulate a complete and coherent picture of the state of the system” (9). Chisholm agrees, “unlike computers that can mindlessly pick up where they leave off, humans often find themselves distracted and unable to concentrate when they return to tasks” (150).

Interruption and Error

How could interruption contribute to medical error? We need to first define interruption then look towards the constructs of human memory for a possible explanation. Interruption has been defined as uncontrollable, unpredictable stressors that produce information overload, requiring additional decision maker effort (162). Furthermore, interruptions typically require immediate attention or action. For simplicity, memory can be divided into two broad categories: long-term and short-term memory. Long-term memory typically refers to the general store of conceptual and factual knowledge as well as experiences framed in our own context (163). Because it is explicit, long-term memory is usually “inactive” and not a current focus of attention unless “activated”. On the other hand, short-term or working memory is a combination of attention, concentration and requires *conscious* participation. It refers to the ability to temporarily maintain and manipulate information that one needs to keep in mind (163). Working memory possess some characteristics that make it vulnerable to interruptions (164):

- (1) Working memory is extremely limited in its capabilities and the number of items that can be held in working memory is small (165).

- (2) Working memory is notoriously the weakest part of cognition and items in working memory are easily disturbed by one another (11).
- (3) Working memory is also limited in duration—evidence shows the powerful negative effects of both interference and diversion of attention on working memory (166-168).

It is not difficult to understand that taking care of complex patients like the ones that reside in the intensive care unit requires a high cognitive load and significant mental attention. It is therefore conceivable that a high degree of interruption could be a “tax” on a physician’s working memory, thereby disrupting it (137;164). This “tax” may subtract from the ability to remember important tasks or digest relevant incoming information. In the medical domain, the failure of working memory *should* raise concern. If interruption threatens to disrupt working memory, then the medical staff are at risk to forget patient tasks. Besides omission, medical staff may repeat tasks leading to inefficiencies or harm, for example, drug duplication. Tasks are often related or sequential, for example, microbiological cultures *before* antibiotics or adequate analgesia *during* a procedure. It is easy to see how these “slips and lapses” can add up to patient harm. Critical thinking may get lost in an interrupt-driven workplace. The implication is simple; more interruptions may equal more medical error.

C. Turn-Taking Interruptions

Our results support previous findings of high interruptive communication patterns in the medical domain. However, we identify a significant and previously unanticipated additional source of interruptions through turn-taking disruption of conversational flow. Our data shows that turn-taking interruptions (T.T.I.) occurred more frequently than conversation-initiating interruptions (C.I.I.). Moreover, T.T.I. and C.I.I. were not evenly distributed across clinical roles. Junior and senior registrars had roughly twice the number of T.T.I. compared to C.I.I. (Figure 5.14). The junior registrars had 155 [45%; 95%CI 40.2-50.8] T.T.I. versus 72 [21%; 95%CI 16.7-25.3] C.I.I. The senior registrars had 301 [45% 95%CI 41.3-48.9] T.T.I. compared to 128 [19%; 95%CI 16.0-22.0] C.I.I. This is sharp contrast to the nurses where C.I.I. were four times as many compared to T.T.I., 145 [35%; 95%CI 30.4-39.6] versus 36 [9%; 95%CI 5.9-11.3] respectively.

Figures 5.15 and 5.16 clearly show that the doctors in this ICU were responsible for the majority of TT interruptions. Of all *initiated* TT interruptions by the observed doctors and nurses, 71% [n=192, 95%CI 65.3-76.0] were by physicians. Similarly, doctors committed 72% [n=160; 95%CI 66.5-78.3] of all *received* TT interruptions. The senior registrar is expected to coordinate most of the patient care. It is therefore not surprising that the senior registrar's TT interruptions represented 61% (n=301; 95%CI 56.9-65.5) of all TT interruptions.

Turn taking is a basic construct of communication and is a ubiquitous part of our lives. Through no formal training, we learn the “rules of engagement” as we encounter a conversation. As such, turn taking can be compared to an economy whereby turns are valued, sought, allocated and often abused. With the present study, it is interesting that turn-taking interruptions appeared to be an extension of a pattern within the medical conversation. A third of all coded events were turn-taking interruptions, similar to the third of all communication events being considered interruptions. Perhaps this communication style is an acquired behaviour? Young doctors learn from and imitate their mentors; both new and seasoned physicians appreciate the deficiency when it comes to teaching communication skills (4;169;170). In the past, the doctor-nurse relationship was unquestionable hierarchical with doctors being superior to nurses (171). Although this is changing, the residue remains (172), despite compelling evidence that patients have better outcomes when collaboration improves (173-175). Furthermore, there appears to be a greater interest in the nursing literature to address communication issues between doctors and nurses (176-179). This may explain why in our study the nurses had so few turn-taking interruptions. Nursing is still a predominately female occupation and gender may have had an effect (180;181), however, there are conflicting opinions (182).

Medical culture may have influenced these results. Although doctors were responsible for the majority of turn-taking interruptions (both initiated and received), they are also accountable for the greater part of patient care. Specifically within this ICU setting, decisions are made by a team that involves weighing many factors, some life saving—the dialogue is understandable chaotic at times. All teams have leaders and the senior registrar is expected (under the guidance of the consultant) to adopt that role. The senior registrar will therefore be a focal point with respect to patient care. This may explain why senior registrars

were responsible for 61% of all turn-taking interruptions. However, local organisational culture or even psychology may have had an influence. Studies have shown that conversational dominance and interruption equate to emergence of leadership and predictors of interpersonal influence (183-185). This study and others cited all involved acute settings (137;139), i.e., intensive care and emergency setting. The extent to which these results might be replicated in less acute settings is unknown. There is evidence that out of hospital clinicians may experience less interruption (150). It is also entirely possible that if non-medical domains were studied, a similar pattern of communication would be observed.

CHAPTER 7 - CONCLUSION

It is axiomatic that communication is pervasive in all aspects of life. Human communication is such a powerful tool that it is often taken for granted. However, like any tool, misuse can often lead to more damage than repair. A few of communication's more desirable characteristics deserve attention. Firstly, communication is easy to use. Although humans receive no formal training, we are able to use communication early in life and acquire proficiency rapidly. Secondly, communication is robust but compact. A vast amount of knowledge and information can be conveyed succinctly. Third, communication is flexible. People with varying degrees of education and expertise are able to use the same tool with various modes (verbal and non-verbal). Furthermore, different cultures with different languages have manipulated the same tool to diverse purposes. Finally, and perhaps most importantly, communication creates, sustains and makes possible human relationships.

Apart from a personal level, communication is also important from an organizational perspective. Communication is the mode by which information is transferred and is essentially for all organizational interactions. Organizations like hospitals are complex structures that use a multi-layered approach to communication. Paging systems, telephones, e-mail, fax and face-to-face are but a few of the modes of communication that medical disciplines use in caring for their patients. In many aspects, communication is at the centre of all healthcare delivery, linking culture, leadership, coordination, and the ability to solve problems. It is in this light that communication patterns were looked at in the intensive care unit.

If the medical community is serious about improving safety it must recognize that errors are symptoms, and that only treating the underlying causes can ameliorate the symptoms.

Medicine should shift evaluation away from counting errors and expecting performance to be error-free. Expecting infallibility from healthcare staff is, not only unrealistic; it is foolish. This strategy ignores the most important part in the equation—the patient! However, there should also be emphasis on detecting errors and managing the consequences of errors. Recognition of error is the first step in working backwards towards discovering where the error sequence germinated.

To the author's knowledge, no previous study has examined the communication patterns of the intensive care ward round, nor analysed for turn-taking interruptions. The results support previous findings of high interruptive communication patterns in the clinical domain. However, this study has identified a significant and previously unanticipated additional source of interruptions through turn-taking disruption of communication flow. The current data shows that turn-taking interruptions occurred more frequently than conversation-initiating interruptions.

Conversation-initiating interruptions have been of interest because of their potential to disrupt working memory and generate error and turn-taking interruptions may have a similar effect on cognitive processes. Clearly some types of interruption are necessary, and further research is required to understand the specific consequences of different interruption forms on clinical activity and error generation. Research is required for deeper understanding of cognitive vulnerability to error and to generate more powerful countermeasures. The overall investment is small compared to the magnitude of the problem. The development of interventions to improve communication patterns hinges on developing such an understanding, and, the armamentarium ranges from education to raise clinician awareness,

through to the development of new mechanisms and technologies that minimise the need to generate interruptions in the first instance.

The important question to ask is what can the medical community do about interruptions if they indeed contribute to medical error? First, there needs to be further study to confirm and describe this phenomenon. Does interruptive communication prevail in other medical domains? The operating theatre and intensive care unit seem logical places to investigate because error can significantly impact patient outcome. However, we cannot ignore how medical staff's style of interaction affects less obvious relationships, for example, the psychiatric patient, and the parent of a sick child or the family deciding whether or not to donate organs. Is interruptive communication epiphenomenal, that is, do physicians and nurses interrupt each other because of other circumstances? Is the perceived stress level, patient acuity or organizational structure the culprit? Where has this manner of communication evolved? Do nursing and medical schools not spend enough time on communication skills or do the mentors teaching these skills serve as poor examples?

Second, there clearly needs to be education informing medical personnel on the consequences of their communication. It is clear from the studies described that participants did not grasp the cost of their selfish communication patterns. Alternatives to retrieving and providing information were not exercised. Synchronous communication dominated the workplace with very little effort in deciding what other substitutes were available. The alternatives, however, need to be in place and shown to work before widely implemented.

Third, specific research aimed to decide on which technology would facilitate a less interruptive model for medical staff to communicate with each other. Communication

technology like mobile phones and wireless e-mail with immediate acknowledge appear promising, but unless tested and the “users” involved in the design, may cause more interruptions than they prevent. The goal is not to eliminate the most important tool of the clinical day, the conversation, but to enhance its capabilities.

There are more questions to be asked but few people willing to answer them. Resources are scarce and money is diverted to more profitable research. However, patient safety is an important agenda and the health community will need to explore less traditional sources of error if we are to finally have all the pieces to the puzzle. The clinical conversation and interruption peppering those conversations will have to be heard eventually.

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